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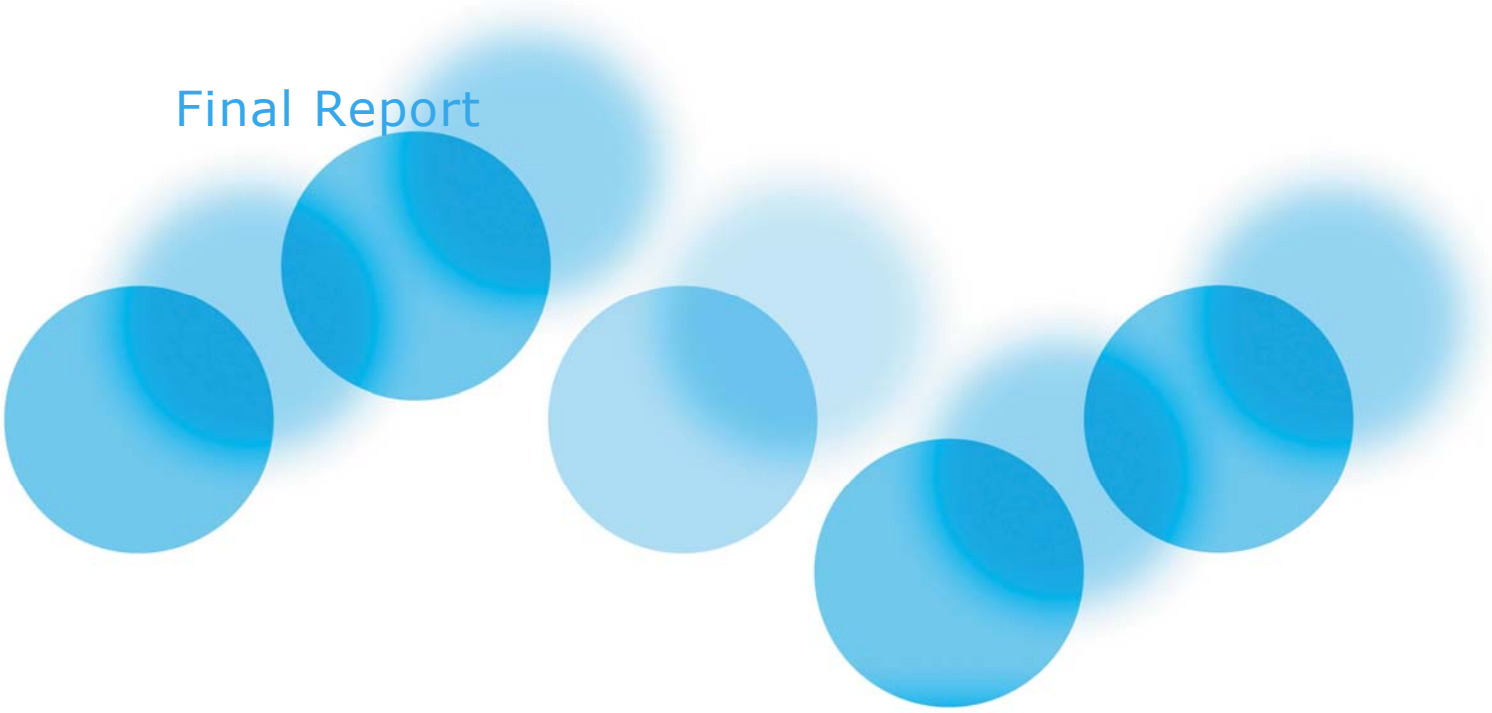
May 2007

Water Tariffs and Related Management Reforms in the Karlovac, Croatia Water Utility: Recent History and Future Prospects

Final Report



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AUTHORS

PREPARED BY:

MAKK

AUTHORS:

Glenn Morris

András Kis

www.makk.zpok.hu
glennmorris@bellsouth.net
kis.andras@makk.zpok.hu

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PREFACE

This report builds on the insights and recommendations developed in Phase I of the Tariffs and Charges Project (Morris and Kis, 2004). It examines in detail the recent and projected experience of Vodovod i Kanalizacija d.o.o. (ViK Karlovac), the water company owned by the City of Karlovac, that provides water and wastewater service in and around Karlovac, Croatia.

While no water system is absolutely typical, ViK Karlovac faces many of the problems encountered by middle size water systems in the region. The staff of ViK Karlovac have been working hard to improve efficiency and to develop plans to replace and upgrade facilities and services, including health and environmental protection services. As part of these efforts, the water system has adopted policies to both marshal its own, limited internal resources and obtain financing and in-kind assistance from local and national governments and other external sources. Thus, the ViK Karlovac experience offers an exceptional window into both the possibilities for, and challenges to, providing higher levels of service in a sustainable fashion.

This report documents the problems faced, the changes made, and the tests ahead for ViK Karlovac, its owner, and its customers. To highlight and quantify this experience, we have used ASTEC (Accounts Simulation for Tariffs and Effluent Charges), a spreadsheet model whose accounts were calibrated to the ViK Karlovac water system. This version of ASTEC was then used to explore what might have been, or what could be, through a series of hypothetical but plausible scenarios. The results of these scenarios, as well as the analyses of ViK Karlovac's situation that these inquiries stimulate, are then used to show how far ViK Karlovac has already come toward meeting its goals and describes the advantages and disadvantages of alternate futures.

ACKNOWLEDGEMENTS

A demonstration project such as this one depends critically on the good will, energy, and material support provided by the management and staff of the organization studied. In both demonstrations examined as part of Phase II of our study, we were extremely fortunate to have found exceptionally talented and compatible partners.

ViK Karlovac, and this report, have benefited from the exceptional leadership and personal commitment of Mr. Josip Šafar, Managing Director of ViK Karlovac, Mr. Krešimir Veble, Manager of the Project Implementation Unit (PIU) at ViK Karlovac, and Mr. Zdravko Eremić, Manager of Accounting at ViK Karlovac. This report was also made possible by the outstanding assistance provided by numerous ViK Karlovac staff, but most especially by the expertise and tireless contributions of Ms. Tatjana Stepinac and Ms. Sanja Horvat. We wish to gratefully thank them and all those involved in supporting and assisting this work - from ViK Karlovac, the City of Karlovac, Jacobs-Gibb Engineering, and the many national and international organizations and institutions involved with ViK Karlovac's planning and financing over the past four years. We would also like to thank Dr. Krzysztof Berbeke and Mr. Spartak Keremidchiev, who reviewed a draft of this report. Any remaining errors are, of course, the responsibility of the authors.

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ABBREVIATIONS AND GLOSSARY

ASTEC	Account Simulation for Tariffs and Effluent Charges, a computer model implemented in Microsoft Excel.
CW	Croatian Waters, an agency of the Republic of Croatia responsible for national water resource development and protection.
DISF	Danube Investment Support Facility, a technical assistance fund to support development of project feasibility studies in the Danube region.
EBRD	European Bank for Reconstruction and Development
FOPIP	Financial and Operational Performance Improvement Programme
HRK	International abbreviation for the Croatian currency, the Kuna. The exchange rate for 2005 used is 7.37 HRK = 1.0 €.
ISPA	Instrument for Structural Policies for Pre-Accession.
MWWU	Municipal Water and Wastewater Utility
PIU	Project Implementation Unit. The organization within ViK Karlovac responsible for implementing ISPA-sponsored measures
SU	Service User
VAT	Value Added Tax
WWTP	Wastewater Treatment Plant.

EXECUTIVE SUMMARY

This report examines the experience with, and potential for, introduction of tariff and other related reforms in the context of the middle sized water and wastewater system serving Karlovac, Croatia. The system, ViK Karlovac, is a public enterprise owned by the City of Karlovac. While ViK Karlovac is blessed with an abundant supply of cheap, high quality groundwater, it has been trying to repair and upgrade itself after years of system neglect and damage due to the civil war of the 1990s. Among the problems it has faced since the late nineties include:

- Incomplete, out of date, or misleading billing records;
- 'Under-metered' or 'non-metered' consumption;
- Delays in payment or non-payment of bills;
- Absence of any but the most rudimentary treatment of wastewater before discharge;
- Leaky water lines;
- Rupture or collapse of older water and wastewater lines;
- Weak local economic conditions;
- Water and wastewater services subject to high taxation to support national institutions; and
- Large differences in tariffs between households and commercial customers.

These features along with other institutional and historic conditions often interacted to make it difficult to obtain support of local decision makers for tariff and other reforms that would help raise the resources necessary to many of these problems. For example, the inequities of the existing tariff design, i.e. the large, unjustified difference between household and industrial tariffs, tend to undermine attempts to raise tariff levels in general.

The process of rebuilding, replacement, and up-grade of ViK Karlovac facilities and services began with 1) a commitment on the part of a group of energetic citizens of Karlovac to re-claim the cities historic vitality, 2) a loan from the World Bank in 1995 to support network re-building and replacement and supporting investments, and 3) a continuing series of investment grants from Croatian Waters and the City of Karlovac to ViK Karlovac. These initiatives were supported and supplemented by a general tariff increase in 2000.

ViK Karlovac committed to a more ambitious program of service expansion and up-grade, and a complementary program of tariff and other institutional reforms, during the first half of the decade. With the assistance of the EU-funded DISF (Danube Investment Support Facility), ViK Karlovac developed an investment program that featured a new Wastewater Treatment Plant (WWTP). It also developed a financing plan that included substantial support from the EU ISPA grant program, a major loan from the European Bank for Reconstruction and Development (EBRD), and "internal" financing of the loan and other expenses through tariff increases, cost reductions, and more efficient collection of bills. ISPA and EBRD subsequently agreed to grant and loan, respectively, most of the financing for the investment program.

During the course of this effort, ViK Karlovac adopted on its own, or agreed to adopt as part of its loan agreement with EBRD, a variety of tariff and related reforms that match to some of the recommendations included in our Phase I report. In particular, it has begun to:

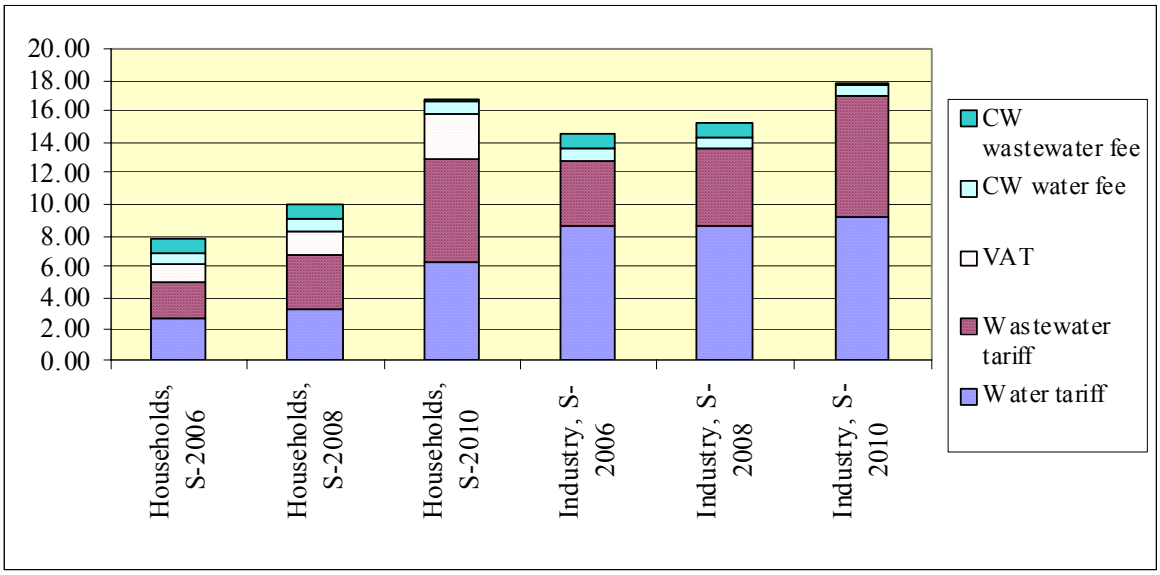
1. Introduce a series of tariff increases to cover the cost of loan repayment, non-eligible costs, and operating costs associated with the investment program;

2. Reduce the disparity between the costs of service and the tariffs paid by households and industry;
3. Increase the bill collection rate by pursuing non-payers more vigorously;
4. Undertake a performance audit to identify ways to reduce the costs of providing current services; and
5. Strengthen its community relations program for explaining the investment activities and their consequences to customers.

While these initiatives have not all been fully implemented, the near term result is reflected in the 2006 financial condition of ViK Karlovac. In 2006, net revenues (revenues collected less out-of-pocket costs) are estimated to be about 6.2 million HRK.[1] Out of these net revenues, provision must be made for new investment and depreciation of infrastructure. Given the nature and size of recent investment levels, this amount seems to be sufficient for us to conclude that ViK Karlovac is in short term financial balance and likely to be on longer term financial balance as well i.e., able to sustain **current service levels** in the long run.

As noted earlier, ViK Karlovac has already committed to a major up-grade in wastewater service. We examined the future implications of this commitment in combination with full implementation of the reforms described above by using the ASTEC (Accounts Simulation for Tariffs and Effluent Charges) model to simulate the physical and financial consequences in 2008 and 2010. We asked ASTEC to find the tariffs that would allow ViK Karlovac to break even under the cost structure and level anticipated in 2008 and 2010. These "break-even" tariffs are shown in Figure 1 below. The ASTEC results included estimates of modest reductions in water consumption and water production relative to 2006 and a major increase in the amount of waste water that was subject to advanced treatment before being discharged into the Kupa River.

Figure 1 Water and Wastewater Tariffs and Associated Fees for Household and Industrial Customers of ViK Karlovac in 2006 and Estimated for 2008 and 2010 (HRK/m3).



[1] The Croatian currency is abbreviated HRK. Most monetary values in this report are given in HRK. For those more used to the Euro, the current exchange rate is roughly 7.4 HRK/Euro. In other words, 74 HRK are equivalent to €10. One way to convert a HRK value into a rough Euro equivalent is to divide the HRK value by

As Figure 1 shows, these results assume that ViK Karlovac will continue to pursue the tariff reforms that have begun in 2004: tariffs have increased to cover the internal cost of the new investments and the difference between the tariffs on industry and households has narrowed dramatically. These policies do, however, also result in substantial tariff increases; particularly for households where they more than double. Despite the substantial grant support for the ISPA-inspired investment program, the costs to ViK Karlovac and its customers are substantial.

To put these tariff increases for households into perspective, we have used ASTEC scenario results to compute crude burden estimates shown in Table 1. While we believe such measures have modest economic merit at best, some find them useful for policy guidance. In this context, we simply note that the calculated burden on three "representative" households more than doubled in each case.

Table 1 Burden Indices for Selected Households for the Baseline and Core Scenarios in 2008 and 2010

Service User Category and Burden Measure	Baseline (S2006)	S2008	S2010
Apt Block Households. Service User Category "Households B". Average expenditure divided by median household net income in 2006.	1.29%	1.74%	2.77%
Individual Houses. Service User Category "Households B". Average expenditure divided by mean household net income in 2006.	1.29%	1.69%	2.63%
Pensioners. Half "Households B" water consumption. Expenditure divided by full pension monthly income in 2006.	1.52%	2.04%	3.25%

These results make a strong case for Karlovac to aggressively implement other tariff and policy reforms it is actively considering:

- Expand efforts to convey information about the ViK Karlovac's plans and expectations for the future through community relations,
- Introduction of a small fixed charge as part of the water and wastewater tariffs,
- Continue to pursue payment from delinquent customers, and
- Aggressively pursue cost-reduction opportunities identified by the external performance audit (FOPIP).

Sensitivity analyses we performed with ASTEC indicated that successful introduction of these changes would substantially reduce the tariff increases needed to support the ISPA-inspired investment program and the political pressures that such changes inevitably bring.

At the same time, we examined some of the more obvious risks that ViK Karlovac and its customers undertake as part of the design of the investment program. We find that these risks, adversely realized, would substantially increase the costs of the ISPA-inspired program.

In conclusion, we find that ViK Karlovac and its partners in the present renovation and upgrade program for the water system have begun a very effective and, if fully implemented, successful set

10 (equivalent to deleting the last digit) and then increase that amount by one third. 6.2 million HRK is roughly equal to 620 thousand Euro plus 1/3 of 620 thousand Euro or €827 thousand.

of tariff and policy reforms. These reforms will make significantly more efficient use of local resources and reduce the cost of establishing a high quality and sustainable water and wastewater system. These current and prospective tariff and related policy reforms have also set management, operating, and financial conditions that make feasible a reduction of transboundary pollutants, such as nutrients and toxics, from the ViK Karlovac wastewater discharges.

We also find, however, that there is room for improvement in certain aspects of ViK Karlovac's investment and reform processes. These improvements include:

- Establishment of an ongoing external performance audit and review to see that the tariff and related reforms continue in both principle and practice. Ongoing benchmark studies should be supported and used to provide more immediate and supplementary performance indices.
- Establishing contingency provisions for external assistance if operating costs, debt service, or other assumptions underlying current calculations of the rehabilitation and up-grade program's cost impose significant, additional burdens on ViK Karlovac and its customers.

Furthermore, based on the Karlovac experience we recommend broader changes in the investment, tariff, and institutional reform process including:

- Establishment of independent data base and analytical capabilities that allow water systems to more fully evaluate investment options in advance, during pre-feasibility and feasibility assessments.
- Support for a program of national and international cooperation among water system managers and owners so that the experience of communities like Karlovac can be preserved and effectively transferred to those just beginning to confront the challenges posed by the introduction of major investments and tariff and related reforms.

1. BACKGROUND OF REFORMS

1.1. The City of Karlovac

The City of Karlovac was established in the end of the 16th Century as a major fortification for protection of Austria and other central European countries from the Ottoman's and others on the Balkan Peninsula. The network of four rivers that converge at Karlovac made it an attractive site. Water from the rivers could be quickly diverted to fill a moat around the star-shaped battlements that surrounded the original military city. In the middle of the 18th century, Karlovac was turned over to civil rule. The remnants of the fortification battlements and the moat still separate the old portion of town from the modern sections of the City. They create a continuous, central park and, together with the rivers, riverbanks, and river flood plain provide modern Karlovac with an attractive natural environment throughout the City.

Figure 2 Karlovac, Croatia and the Surrounding Region

1.2. City Economy

The City of Karlovac is a regional trade and administrative center of roughly 60,000 people. Karlovac and the surrounding region have an industrial base that emphasizes metal fabrication, textiles, engineering services, etc. It also has a continuing military presence, with military barracks. Unfortunately, many formerly prominent local companies have recently gone bankrupt due to the restructuring of the economy following the dissolution of the Soviet Union, Croatia's withdrawal from the Federal Republic of Yugoslavia, and the "homeland war" of the mid-1990s. Also, the military presence in Karlovac has been sharply reduced in recent years. A bright spot in the local economy is the Karlovacko Brewery, now owned by Heineken of Holland. The brewery is both a major employer and the largest water consumer in Karlovac.

Karlovac has many burdens that are the legacy of the "homeland" war. The City suffered shelling during the homeland war and many buildings were damaged and a few were destroyed as a result. It also had to deal with an influx of refugees from the surrounding countryside and other parts of

the former Yugoslavia. In the countryside and some part of the town, thousands of land mines had to be disarmed and there are still a few areas where "de-mining" needs to be completed.

Despite general improvement since 2002, economic conditions in Karlovac continue to be difficult. Unemployment has remained high at 27.6% reported for Karlovac County for 2005 by the Croatian Statistical Office, and there is still a great deal of economic pressure on those local firms that continue to operate. As a result, wages and incomes in Karlovac County are below the national average. In 2004 the average net wage income of Karlovac County was only 92% of that for Croatia as a whole. There is, in general, a migration of the youngest and best-educated residents to Zagreb, coastal Croatia, or elsewhere where wage levels and employment opportunities are better. Furthermore, the City of Karlovac now has more local responsibility for financing as well as providing a variety of public services resulting in increased pressure on the City budget and a limited income stream with which satisfy this pressure.

1.3. Karlovac Water Service

The central city of Karlovac has had water service since the establishment of the city in the late 16th century. As the city grew, so did the water service. Over time, storm water systems were merged with sewerage systems and a combined network was established in the 1930's (Jacobs-Gibbs, 2004). Together these systems evolved and modernized. The current basic system of public wells, central distribution of potable water, and combined wastewater/storm water collection has been in place since the early part of the 20th century.

Karlovac has an excellent, low cost water supply providing high quality water to the city from a small system of rather shallow, high yield wells. Its water network serves most of the residences and enterprises in the central parts of the town. In recent periods the system has expanded into the suburbs and surrounding villages as the city and the population of the area grew and disbursed. Many residents of the city periphery have water service provided by the City water system. Villages and settlements more removed from Karlovac have requested that the water networks be extended to them.

The incidence of wastewater service is very high in the center of Karlovac. There are, however, substantial numbers of water customers on the periphery of the City who do not also receive wastewater service. The wastewater and storm water that is collected by the sewerage network is discharged into one or another of its rivers with little or no treatment.

Ownership and administration of the water system have changed with the change in legal and institutional conditions. In 1996 Vodovod i Kanalizacija d.o.o. (ViK Karlovac) was created as part of the Croatian devolution of water and wastewater operations to local authorities. The City of Karlovac is presently the sole owner of ViK Karlovac. Except for a small section of the wastewater network in the center of the City, which is directly owned by the City, ViK Karlovac owns all plant and equipment as well as the water and wastewater infrastructure.

In 2005 ViK Karlovac served over 33,000 customers who consumed nearly 5 million m^3 of water.[2] The ViK Karlovac sewerage system had over 22,000 customers who produced roughly 3 million m^3

[2] The number of customers is based on the number of separately billed accounts, not the population served. These accounts include commercial and industrial customers and public customers (such as schools and City of Karlovac operations) as well as households. Unlike many water systems in the DRB, ViK Karlovac or its billing agent invoices each account separately, even when multiple apartments are served by a single water meter. In these later cases, a customer account's water bill is based on pro-ration of the metered consumption in accordance with an allocation formula.

of wastewater per year. ViK Karlovac had revenues of over 33 million HRK in 2006 (€4.5million); over 22 million HRK from water service and over 11 million HRK from wastewater service.

The City, through the City Assembly and an associated Supervisory Committee, appoints the General Manager of ViK Karlovac, provides policy guidance to the General Manager, and reviews all significant decisions, e.g. tariff proposals, investment plans. ViK Karlovac Sewerage Department currently engages in a few non-core activities such as pumping of septic systems, maintenance of drainage gullies on City land, certain construction activities, and maintenance of the fountains in the city. While revenues from these services vary from year to year, generally they account for less than 10% of system income. The General Manager and the ViK Karlovac staff directly operate and manage most of the present system. An exception is the compiling of invoices and collection of bills for ViK Karlovac service from households and some of the small enterprises. This is currently done by the service organization Inkassator d.o.o. ViK Karlovac also contracts for maintenance and repair services for larger, scheduled projects.

2. INVESTMENT AND OPERATING CHALLENGES FACING VIK KARLOVAC

Like many communities in the lower Danube River Basin, but most especially small to middle size cities, Karlovac is recovering from a period of economic transition and political instability. This recovery process has limited ViK Karlovac's customer's incomes and the monetized wealth upon which they can draw. At the same time ViK Karlovac's owner, the City Council of Karlovac, has both ownership of the water system and is politically dependent on ViK Karlovac's customers. This naturally creates a variety of economic and political tensions that both contribute to, and complicate, solution to the challenges discussed below. This background, and the fact that many of these problems are inter-related e.g., non-payment and billing data problems, extending sewer service and protecting the water supply, make Karlovac a fairly typical, medium-sized water system in the region.

2.1. Metering and Billing

2.1.1. Household Billing Records Are Sometimes Incomplete, Out of Date, or Misleading

Inkassator o.o.b. is a contactor to ViK Karlovac with responsibility for household and small enterprise billing and bill collection for water and wastewater services.[3] Inkassator receives water consumption data from ViK Karlovac. It then issues bills directly to those consumers which are individually metered based on the amount metered. It prepares invoices for customers who are jointly metered e.g., customers in apartment buildings with a common meter, by dividing up the metered consumption of the jointly metered customers based upon specific formulae that depend largely on the number of residents of each flat. Inkassator then issues the resulting invoices for each business, dwelling, or apartment unit; collects the invoiced amount from customers; retains nine percent of the amount collected; and forwards the remainder to ViK Karlovac. In case of Croatia Waters water and wastewater fees collected by Inkassator, the level of the compensation by ViK is 5%, the same percentage that ViK receives from Croatia Waters for the same service.

For any newly built apartment building a separate meter is now required by law for each and every apartment, but old buildings without individual apartment meters continue to predominate in Karlovac.

ViK Karlovac has limited control over the effectiveness and timeliness with which Inkassator collects revenues on its behalf. Furthermore, Inkassator has sometimes been unable to provide good quality and timely information about its data and operations for the purpose of establishing baselines for our analytical work. ViK Karlovac does not know the status of payment for individual customer accounts, and extracting data for purposes of analysis from the databases of Inkassator proved difficult and unreliable. Most recently Inkassator reported to ViK Karlovac that all computer files of billing data prior to 2005 had accidentally been destroyed. This implies that archiving of data is not managed well within Inkassator. Inkassator is also suspected of unnecessarily delaying

[3] Inkassator o.o.b. also handles the billing and account collection for the municipal solid waste service.

transfer of some payments to ViK Karlovac. Lastly, the fees paid to Inkassator have not been tested recently to see that they are commensurate with the market price of such services.

2.1.2. "Under-metered" Consumption

ViK Karlovac management believes that many of the operating water meters in Karlovac under-measure actual water consumption. This under-measurement is thought to result from a variety of technical conditions.[4] The result, however, is under-reporting of water use, over-reporting of system losses, and a reduction in the revenue stream of ViK Karlovac.

2.1.3. Customers in Most Apartment Buildings are Jointly Metered

Thirty percent of household customers are jointly metered i.e., multiple apartments are served by a single meter. This condition has dual implications for the operations of ViK Karlovac. Since many household water bills are not based on actual consumption of water by that particular household (see 2.1.1 above), it is likely that these households over-consume and thereby contribute to higher overall variable costs of operation[5]. Another problem, which may be more of a prospective than current problem for ViK Karlovac, is that these households – those where the amount of water and wastewater services billed is not the necessarily the same as the amount consumed - are more likely to oppose any substantial future tariff increases on the grounds that it exacerbates an already unfair and inefficient system.

2.1.4. Delayed or Non-Payment of Invoices

According to ViK Karlovac staff, sometimes 10-15% of water and wastewater service bills were not paid within a year of being issued during the early years of this decade. Due to improved economic conditions and efforts of ViK Karlovac to improve collection, in 2005 unpaid bills were estimated to be between 4 and 5% of issued bills. This change is discussed further in section 3.2.4.

2.2. Prospect of Stricter Regulations

The Republic of Croatia aspires to join the European Union and, as part of this effort, encourages local water and wastewater systems to move toward compliance with EU environmental directives. These include water quality standards, water and wastewater service proportions, effluent discharge standards, and ambient water quality standards. Karlovac and ViK Karlovac can expect heavy political and economic pressure to expand water and wastewater services and to treat wastewater before discharging it into its rivers.

[4] Two problems cited by ViK personnel are: 1. replacement or calibration of water meters is not always done with proper frequency and 2. old, large water meters cannot accurately measure low water flows. During periods of low consumption, therefore, water goes through the meters without being measured.

[5] The argument here is that since any individual household splits the cost of each unit of water consumed with its neighbors, then the effective price of that additional unit of consumption is some – often small – fraction of the nominal price. This encourages additional consumption by each household and, if all the jointly billed households behave in this way, both household and aggregate consumption is much higher than it would if each household paid only for what it consumed. In this latter case, each household would make its consumption decision based on the full, variable tariff charged for water service and, at that higher effective price, both household and aggregate consumption would be lower.

2.2.1. Wastewater Treatment Requirements

The sewer system dumps wastewater with no treatment into the river system in and around Karlovac at several points. Indeed, during periods of high flow it actually must pump its raw sewerage and storm water runoff into its rivers. The EU Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment requires that water systems in the EU like ViK Karlovac treat wastewater. The level of treatment required depends on the designated "sensitivity" of the receiving water body. Anticipating this requirement, ViK Karlovac wants to build both interceptor sewers that will collect wastewater and a wastewater treatment facility.

These facilities are very expensive and financing these investments would stretch, and perhaps exceed, feasible amounts of locally available resources. In order to get these projects under way in the near term, ViK Karlovac will need to find external sources of financing.

Financing issues, however, are intertwined with a number of other wastewater treatment issues. Consider, for example, questions of wastewater treatment plant design. Industrial wastewater customers are being required to adopt "pre-treatment" technologies for their effluent. Having made initial investments, some industrial customers may decide to upgrade treatment and promote recycling of wastewater. This may reduce the discharge into the sewer system to some extent. Such decisions will affect the desired design capacity of the municipal wastewater treatment plant as well as the level of treatment required by the WWTP if ViK Karlovac is to meet standards. ViK Karlovac might be able to reduce the initial financial burden of the WWTP by adopting flexible designs, and making contracts for provision of specific wastewater services with key industrial customers.

2.2.2. Expanding Provision of Water and Wastewater Services

There are economies of scale in wastewater treatment, so it is corollary of wastewater treatment that extension of the water and wastewater collection network should also be examined. This includes consideration of both the size of the service and increasing the fraction of entities in the current service area that receive water and wastewater service. Most residents and businesses in the ViK Karlovac service area are served by the water network, and about two-third of these customers also discharge their wastewater into the sewer. There are also nearly two hundred commercial and industrial water customers who don't currently have sewer service. Clearly, Karlovac still has some latitude to increase sewer service in its existing service area and, in so doing, increase the design capacity of the wastewater treatment plant. Such an initiative, however, has to balance the potential economies of scale against the costs of making the new connections.

2.3. Constituencies Opposing Release of Untreated Wastewater

Untreated wastewater may have adverse effects on the ecology of the local rivers. Some of the local fishermen complain that fish and crab they used to see years ago have by now disappeared from the water bodies downstream of the sewer discharges. During hot summer days, especially when water flow in the rivers is low, some river sections release bad odors, likely due to the high fraction of wastewater in them.

Some of the towns downriver from Karlovac, such as the town of Sisak, get their drinking water from the Kupa River. When the wastewaters of Karlovac are not yet diluted enough, they pose a

threat to the quality of drinking water in these cities, and may impose higher treatment costs on local water systems.

2.4. Need to Continue Replacing Old Network Infrastructure

Both the water system and sewer system of ViK Karlovac are old and showing signs of this age. At present, nearly 48% of water production is unbilled, and much of that unbilled amount is lost in distribution due to leakage in the aging distribution network. Furthermore, regular breaks in the system require emergency repairs to prevent water damage from flooding.

The sewer system combines storm water and wastewater. It, too, suffers regular breaks and emergency repairs need to be made in order to prevent the system from backing up into customers' homes and businesses. Because the sewers are old, they are also especially susceptible to infiltration. It is estimated that infiltration typically adds up to 30% in wastewater volume during "dry flow" periods.

Over the past decade ViK Karlovac has made investments in "refurbishment" and/or "replacement" of network components, partly financed from external sources. In particular, it has replaced many of the old water pipelines and main sewer lines in downtown Karlovac. There is, however, still a lot of work that could be done and, long term, it may make sense to separate the storm water and wastewater networks. While during the past 10 years ViK Karlovac spent over HRK 5 million on network rehabilitation and replacement, more than twice as much money, over HRK 10 million of ViK Karlovac resources, was used for water and wastewater network extensions. More detail on these investments is presented in section 5.1.5.2.

2.5. Financing Infrastructure

ViK Karlovac has difficulty financing extension of the infrastructure and replacement of assets from own resources. For the past ten years, only about 25% of investments made by ViK Karlovac were paid for by ViK Karlovac from its own resources (see section 5.1.5.2 for details). And even this contribution was only made possible by access to commercial loans. The rest of the investments were paid for by grants from either the City of Karlovac or the central government, especially Croatia Waters. The annual ViK Karlovac investment plan for 2006 budgets HRK 12.7 million, but the management of ViK Karlovac claims that these planned investments can only take place if external, grant financing will continue to cover the majority of these investment costs.

2.6. Threats to Water Supplies

Some of the wells supplying water to Karlovac are located near the banks of Korana River. There is a strong possibility that polluted river water will contaminate these wells. The community is concerned to protect its water wells from upstream wastewater discharges and has just completed construction of an interceptor sewer that will service up-stream wastewater dischargers, particularly those whose water service is provided by the upstream community of Duga Resa. For the time being this interceptor sewer simply moves the discharge point for this wastewater downstream. If the wastewater treatment plant is built, then this wastewater will be treated before being discharged.

Upriver extension of the sewerage system is also important to the west of Karlovac. Discharge of sewerage into the Kupa River and the related aquifers threatens the water quality of major ViK Karlovac water supply wells located near the Kupa River.

2.7. Tariff Distortions

Tariffs for customers classified as commercial or industrial entities have typically been set at least twice as high as tariffs for households. For example, in March 1, 2006 household water and wastewater tariffs together, excluding VAT and Croatia Water fees, were 5.0 HRK/m^3. The corresponding commercial/industrial tariffs were 12.78 HRK/m^3. Since it is unlikely that, under current service conditions, serving commercial/industrial customers costs more than serving households, we can conclude that the current tariff scheme has industrial and commercial customers cross-subsidizing households and small consumers. Put another way, with these tariffs household are consuming inefficiently large amounts of water and industries are probably over-conserving water.

There is also some evidence that larger household consumers are cross-subsidizing small seasonal and weekend water customers. Since all costs are recovered by a variable or consumption charge, the fixed costs of operation are allocated to water users on the basis of the amount of water consumed. There is no reason to believe that the fixed costs of service vary between conventional customers and the small seasonal or weekend customers, but this tariff structure results in conventional, continuous users paying a disproportionate share of the fixed expense. This also has an adverse effect on efficient water use: to include the expense of fixed costs in a customers variable charge inefficiently discourages water use. This particular inefficiency may be significant even if demand for water is inelastic, since fixed costs are a very large share of total costs of operation.

2.8. Tax Burden

The customers of ViK Karlovac pay for both the cost of water and wastewater services, but also pay substantial fees and value added taxes to agencies of the central government.

2.8.1. Croatian Waters Fees

Croatian Waters is an agency of the central government. It performs a variety of management, information and investment activities connected with water resource management in Croatia (Croatian Waters Website, www.voda.hr/en/about_us.htm). To support its activities, Croatian Waters is empowered to collect fees on each m^3 of water billed by municipal water systems. In 2006 the water fee paid to Croatia Waters is 0.8 HRK/m^3 of billed water, or 29% of household water tariffs (before VAT) and over 9% of commercial water tariffs. The wastewater fee paid to Croatia Waters is 0.9 HRK/m^3 of billed wastewater, or 40% of household wastewater tariffs (before VAT), and 21.7% of commercial wastewater tariffs.[6] For the most part Croatia Waters fees are collected as part of the water and wastewater bill and are placed on a special account from which, after a deduction of 5 percent by ViK Karlovac for service, they are transferred to Croatia Waters. These transfers are registered neither on the revenue, nor on the cost side of ViK Karlovac books. The Croatia Waters fees are not subject to VAT. The largest polluters in Karlovac are subject to effluent based wastewater fee payments, and they do not pay these fees through ViK Karlovac, but directly to Croatia Waters. Annual payments of water and wastewater fees to Croatia Water

[6] The wastewater fee drops if wastewater is treated before discharge into a water body. The better the effluent water quality upon discharge, the lower the wastewater fee.

exceed HRK 6 million per year. This is in the same magnitude as the average annual investment grant received by ViK Karlovac in the last ten years from Croatia Waters (about 4.2 million HRK/year) and the City of Karlovac (about 1.2 million HRK/year).

2.8.2. Value Added Tax

ViK Karlovac includes a 22% Value Added Tax (VAT) on water and wastewater service invoices to its customers. The VAT included in each bill must be paid to the Croatian Tax Authority monthly shortly after the bills are issued. While commercial customers can pass these taxes up the line to final consumers, households are responsible for paying these taxes. From the household perspective, VAT makes water and wastewater service 22% more expensive (before Croatian Waters fees are also added).

The VAT compounds the financial problems of ViK Karlovac associated with non-payment. VAT is paid on the amount of water service billed, not on the amount of revenues collected from customers. Therefore ViK Karlovac losses from unpaid residential bills are amplified by 22% until the bills are declared "uncollectible" and the VAT is credited back to ViK Karlovac. This process can take a considerable time and, in the interim, ViK Karlovac has made an interest free loan to the central government. In the past this system has given rise to slight of hand in accounting: water services provided with little expectation of actually recovering payment was not been formally billed and the VAT was not paid.

2.9. The Possibilities for Self-Supply

2.9.1. Large Industry

Industry in Karlovac pays a much higher tariff for water and wastewater services than households. Some of the difference between commercial and household wastewater tariffs may, in the future, be justified by different treatment requirements, but the cost of supplying water to different customers is more or less the same. If industry pays a very high tariff for water service, some of the big consumers may investigate the possibility of developing their own water supply by drilling a well on or near their property. Many obstacles may stand in the way of creating a new well: high costs, administrative barriers, legal difficulties, technical problems. Nevertheless, it cannot be ruled out that some of the customers may take steps in this direction and ViK Karlovac may lose some of its water business.

In the case of wastewater discharge, under the present regulatory environment it is highly unlikely that any of the industrial facilities would be granted the right to build their own WWTP and sewer, and discharge treated wastewater directly into the river.

2.9.2. Household Customers

Considering the low prices of household water service, self-supply of drinking water from wells is not widespread in areas where the water network is available. Even at substantially higher prices, it is unlikely that most urban household customers would find it attractive to switch to self-supply.

Wastewater service, however, is another matter. As noted above, many households receive water service from ViK Karlovac but do not have wastewater service. According to the Jacobs-Gibb (2004) those customers that are not connected to the sewer have closed tanks to receive sewerage. These are periodically pumped and the wastewater disposed. Within the city ViK

Karlovac operates a collection service that periodically pumps these tanks and disposes of the wastewater by pumping it into the sewer network near the main pumping station. Whether these customers will find it attractive to keep their current system of self-supplied sewer service as ViK Karlovac's wastewater network expands or whether circumstances will change to encourage – or to compel – these customers to choose wastewater service with ViK Karlovac is uncertain.

Another consideration concerns the proper servicing of the private sewerage storage tanks: less frequent service reduces costs – making the switch to using the wastewater network less economically attractive – AND likely increases the effluent that is released from the storage tanks. The actual practice of those households that self-supply sewerage services certainly deserves closer examination and regulatory action if it appears that this option is being abused.

3. CURRENT TARIFF AND RELATED REFORM INITIATIVES

ViK Karlovac has begun a series of pricing and policy initiatives to address some of these issues, many of which are directly or indirectly connected to tariff and policy reforms. Those described in the following section were introduced some time ago, usually earlier in the decade, and are functional at present. Their impacts on costs, revenues, and tariffs are already embodied in baseline data used in the ASTEC model discussed below.

3.1. Cost Reduction

Some of the initiatives will result in cost reductions directly, others will involve initial expenditures or investments that will, it is hoped, reduce costs in the long run. These changes may also result in changes that improve the quality of service and, while not cost saving per se, increase cost-effectiveness.

3.1.1. Replacing Central Wastewater Mains

Since 2002 several km of aged, leaking wastewater mains have been replaced in the downtown area of Karlovac. Total investment costs were in excess of HRK 4.5 million. Twenty five percent of the total was financed from grants provided by Croatia Waters; almost 40% of the total investment was paid for by the City of Karlovac. The rest, slightly less than 40% of total investment, was paid by ViK Karlovac.

Before these investments took place, the majority of ViK Karlovac's annual repair and maintenance budget was spent on the sewers of the old city (Jacobs-Gibbs, 2004). The annual cost savings, while never quantified, are probably substantial.

3.1.2. Automation and Centralization of the Water Monitoring and Dispatch System

Between 2001 and 2004 ViK Karlovac introduced a Supervisory Control and Data Acquisition (SCADA) system in order to automate the measurement and control of water extraction and water dispatch through the network. Implementation of SCADA cost about HRK 940,000, fully financed by ViK Karlovac. The SCADA system not only provides data about, and improves the quality of, the physical operations of ViK Karlovac, it also reduces costs. Since ViK Karlovac pumps water from several wells and has some water storage facilities as well, it has some control over which pumps to use and when to use them. Since some of the pumps are more efficient than others, and electric rates vary by time of the day, use of the SCADA system enables ViK Karlovac to reduce electricity costs through more efficient deployment of pumps and pumping. The SCADA system also takes care of some of the tasks which would otherwise require additional labor, reducing ViK Karlovac labor costs. Thus far there have been no attempts to quantify the cost savings derived from use of the SCADA system.

3.1.3. Sub-Contracting Major Maintenance and Repair

ViK Karlovac has been sub-contracting for major maintenance and repair of system infrastructure. Expenditures in 2005 and 2006 are shown in Table 2 and Table 3 respectively. These contracts were awarded by ViK Karlovac on a competitive basis for one year at a time, and this practice should help reduce system costs. The rest of the repair and maintenance work, such as flushing the system and cleaning sediments, are carried out within ViK.

Table 2 2005 Sub-Contracting of Maintenance and Repair

Contracted Activity	Firm	Amount of Contract (HRK)
Repair and calibration of water meters	Grbar	379,441
Maintenance of buildings	Gradiv	747,635
Maintenance of pumping facilities	Turboteh	571,700
Maintenance of electric power facilities	Ena	428,342
TOTAL		2,127,118

Table 3 2006 Sub-Contracting of Maintenance and Repair

Contracted Activity	Firm	Amount of Contract (HRK)
Repair and calibration of water meters	Grbar	241,150
Maintenance of buildings	Gradiv	723,265
Maintenance of pumping facilities	Turboteh	521,190
Maintenance of electric power facilities	Ena	179,363
TOTAL		1,906,118

3.1.4. Individually Metered Apartments

Under the new Law on Communal Activities (Official Gazettes 128/99), local Decree in Karlovac Gazettes 8/04, any newly built, or renovated, multiunit apartment building must be constructed or renovated with a separate meter in each living unit. This will, over time, reduce the number of jointly-metered customers and increase the customer's incentive to reduce consumption. This will, in turn, reduce the aggregate operating costs for both water and, if provided to the customer, wastewater service. The time frame of this adaptation is considerable. At present ViK Karlovac has no plans to provide additional incentives for established, jointly-metered customers to make the investment in individual meters.

3.2. Revenue Enhancement

These reforms involved both changes in tariffs and expansion in the customer base. The increases in tariffs were motivated strictly by the prospects of higher revenues, albeit sometimes to offset higher costs during an inflationary period. The other reforms were fuelled in part by the desire of ViK Karlovac to increase its customer base and in part by demand on the part of peripheral neighborhoods and communities to be included on the ViK Karlovac water or sewer network. In fact, it is uncertain whether the financial position of ViK Karlovac improved at all as a result of this

infrastructure development, i.e. whether the increase in revenues associated with increasing the customer base offset the increase in costs either before or after accounting for the grants from the city or Croatian Waters that helped offset the initial costs of network extension. We examine this issue in more detail in Chapter 1.

3.2.1. Tariff Increases

ViK Karlovac increased tariffs across the board in 1998, 1999, 2000, 2004, and 2006. Tariff increases in 1998-2000 were primarily an attempt to keep pace with domestic inflation. Tariffs were increased again in 2004. The series of tariff revisions resulted in a nominal tariff increase of 40% for water and wastewater (Jacobs-Gibb, 2004, p. 18). The effective nominal increase for tariffs paid by customers was about 30% per m^3.[7] In real terms, the increase over 2000 tariffs by tariffs increased in 2004 was 9 %.

Table 4 Nominal Tariffs Applied by ViK Karlovac between 2000 and 2006 (HRK/m^3, without VAT)

Tariff Type	2000 to May 2004	June 2004 to Feb. 2006	March 2006 on
Household Water Tariff	2.00	2.41	2.75
Household Wastewater Tariff	0.95	1.14	2.25
Commercial Water Tariff	6.5	7.83	8.63
Commercial Wastewater Tariff	1.75	2.11	4.15

3.2.2. Expanding Water System to Pokupska Dolina

A new water main and some secondary network segments were built between 2000 and 2005 in order to extend the water network to Pokupska Dolina, a neighborhood adjacent to the current service area. This was the most significant water network investment of the last five years, and it resulted in about 250 new household connections. The investment took place in two stages, with a total cost of about HRK 10.3 million, more than half of which was paid for by a Croatia Waters grant. The rest of the investment was financed by ViK Karlovac, partly through a commercial loan with annual amortization of about HRK 700,000. While each newly connected household paid a one time fee of from HRK 3,500to HRK 5,500 to be added to the network, and HRK 2,000 per new connection was contributed to the project by the City, the investment cost actually borne by ViK Karlovac works out to almost HRK 20,000 per connection.

3.2.3. Building the South Wastewater Collector

As noted in Section 2.6, Duga Resa is a near-by, upstream community that is also home to several large industrial operations. Duga Resa has an independent water supply and distribution system and wastewater network that has, like Karlovac, discharged wastewater into the Korana River. Duga Resa's industrial suburbs are also located along the river and, while they have fallen on hard time recently with some of the more prominent of the textile facilities closing, the remaining firms still operate and discharge effluents into the Korana River. This new piece of the Karlovac wastewater system intercepts the discharge lines from Duga Resa and the suburban firms and ships the wastewater to a discharge point below Karlovac and near the site of the new WWTP. This

[7] The percentage increase was lower than the percentage increase in the core tariff because the Croatian Waters fees increases the baseline tariff faced by customers of municipal water systems in Croatia.

part of the ViK Karlovac wastewater network began functioning in 2006 and will carry wastewater to the WWTP when the plant becomes operational.

Duga Resa however, does not yet pay any tariffs to ViK Karlovac. In the near future, before construction of the WWTP, ViK Karlovac hopes to finalize a contract with the municipality of Duga Resa covering provision of services.[8]

3.2.4. Improving Collection Rates

ViK Karlovac began a program to improve collection rates during the early part of the decade. The program consisted of threats of disconnection to non-payers, actual disconnection, taking non-paying customers to court, and publishing their names in local media.

In 2005 the company issued 326 notices (or warnings) to late paying legal entities, threatening them with disconnection of service. In 60 cases, customers were indeed disconnected. Some of the delinquent payers ended up in bankruptcy, making collection of outstanding revenues very unlikely. At the same time, these bankrupt companies will not consume water in the future, therefore the scale of future non-payment is reduced.

Some of the non-payers were taken to court, but the compensation received after these legal cases was often nothing more than equity positions in the companies and ultimately proved either worthless or, in certain cases, penalizing.[9]

Another problem was caused by publication in local newspapers of the names of customers whose payments were severely in arrears. The publication did, indeed, embarrass the non-payers, some of whom were politically or economically prominent. While publication did prompt some of the non-payers to make full or partial payment, it also turned out to violate privacy statues that made such public disclosure of customer account information without the consent of the customer illegal. Because of this, the publication program had to be discontinued. The actual effect of this short-lived program has never been measured, partly because it is very difficult to measure.

3.3. External Assistance

In recent years ViK Karlovac has been successful in obtaining some external assistance to help it address some of the issues described in Section 1. Here we summarize this assistance and note that these programs have already made progress in ameliorating some of the problems associated with aging or damaged networks and planning for wastewater treatment.

[8] As already noted, ViK Karlovac recently began providing wastewater network services to Duga Resa. There is some uncertainty about the nature, extent, cost, and payment for services that ViK Karlovac will provide Duga Resa residents and organizations in the future. In the core of our analysis we assume only that ViK Karlovac intent to collect for the wastewater services it provides has been realized.

[9] Forgiving a debt obligation in return for an equity position in a firm was not un-common during the hard economic times occurring during and following the Homeland War. Such trades have downsides, however, as ViK Karlovac learned. During this period ViK was sometimes asked to forgive water service debts in return for equity positions in the business activity of its customers. Unfortunately these equity positions were based on paper, rather than real assets, the value of these stocks frequently went to zero, and ViK did not see any revenue from them.

3.3.1. World Bank Loan

In 1995 the Republic of Croatia borrowed funds from the World Bank to finance some infrastructure projects. Part of this loan was distributed by Croatian Waters to ViK Karlovac to support infrastructure repair and replacement. ViK Karlovac paid the principle and interest on this loan for seven years to Croatian Waters which, as an agent for the State, then passed these payments to the World Bank.

In December 2002 the Ministry of Finance decided that water companies and other public utilities that had received the loans, including ViK Karlovac, no longer had to pay principle and interest to Croatian Waters and Croatian Waters would be responsible for repaying the balance of the loans from its fee income. In return, CW was given an opportunity to take a comparable equity position in the water systems. As of 2006, however, CW did not file necessary paperwork and its option for an equity position in these firms expired. According to ViK Karlovac management, ViK Karlovac would have been able to repay the loan to the World Bank, but the Government's decision on repayment covered all of the participating public utilities.

3.3.2. Feasibility Study

In 2002 ViK Karlovac was selected to host an EU-sponsored, technical assistance project to evaluate water and wastewater system needs and help prepare feasibility studies and supporting materials for use in applications for grants and loans. This project, under the umbrella of the Danube Investment Support Facility (DISF), was conducted at ViK Karlovac by Jacobs-Gibb Engineering. Jacobs-Gibb collaborated with ViK Karlovac on performance of an engineering assessment that was, in turn, used to develop cost estimates and a financing strategy for a program of measures to up-grade ViK Karlovac's water production facilities; further repair, replace, and extend water and wastewater networks; and build and operate a WWTP (Jacobs-Gibb, 2005). This assistance and the resulting reports were critical to initiation and execution of the current external assistance initiatives described in Sections 4.1.1 and 4.1.2 below.

3.3.3. Central Government and the City Grants

Croatian Waters and the City of Karlovac have been active in providing external financial support for a variety of ViK Karlovac investments. The major investment programs of ViK Karlovac over the last ten years, and the participation of CW and the City, are described Table 11 below.

4. NEW OR PROSPECTIVE REFORMS

4.1. Financial Assistance

4.1.1. ISPA Grant

ViK Karlovac, with the support of the Government of Croatia and the City of Karlovac, applied in 2004 for financial assistance from the European Union's Instrument for Structural Policies for Pre-Accession (ISPA) grants program. This program provides investment grants for public infrastructure projects in countries in the "pre-accession" phase of the EU membership process. This application was based on the various measures and costs identified in Jacobs-Gibb draft report (2004). It includes the following investment activities:

- Water supply survey and well cleaning,
- Water and wastewater network replacement and expansion, and
- A central WWTP.

ISPA grants typically cover only part of the capital investment in infrastructure and they do not provide financial assistance covering any costs of operation. The ViK Karlovac application called for an ISPA Grant that provided 62.5% percent of the "eligible" capital costs with the remaining capital financing to be covered by a commercial loan and supplementary funding by ViK Karlovac and the Government of the Republic of Croatia. Indeed, successful application for a supplementary commercial loan is a condition of receiving the ISPA grant.

As originally proposed, ViK Karlovac's WWTP would provide only primary and some secondary wastewater treatment. At ISPA staff urging, this was subsequently modified in an amended application in 2005 to include additional treatment of sewerage and reductions in nutrient loads. ViK Karlovac's proposed WWTP now includes full secondary treatment and de-nitrification.

The activities, costs, and other aspects of this ISPA-inspired investment program are detailed in the Prospective (Future) Scenarios described in Section 5.

The final cost estimates for the investment program, as well at the actual design and more specific attributes of the investments, will only be available after completion of engineering design studies. Of particular concern are the operating costs of the WWTP. The estimates provided by Jacobs-Gibb are not well-documented and appear to have been slightly reduced at the same time that the nature and extent of wastewater treatment have increased under the terms of the amended ISPA application.

4.1.2. EBRD Loan

ViK Karlovac successfully met the commercial loan conditions of the ISPA grant by negotiating a €10 million loan with the European Bank for Reconstruction and Development (EBRD). The loan agreement was negotiated in 2004 and the loan agreement was signed in 2005. The City of Karlovac is the guarantor of the loan.

The terms and conditions of this loan are complicated and include the following elements:

- The loan is for thirteen years but principle and interest payments are delayed for three years. In the interim interest accumulates and ViK Karlovac must pay an origination fee.
- The interest rate is tied to a European Bank Rate and is adjusted every six months.
- The loan and repayment are denominated in Euros.
- ViK Karlovac must undertake a Financial and Operational Performance Improvement Programme (FOPIP) study to increase operating and management efficiency, i.e. to reduce costs.
- ViK Karlovac must negotiate a formal Service Agreement with the City of Karlovac.
- ViK Karlovac must reduce the difference between industrial and household tariffs. There must be a 50% reduction in the differential between domestic and commercial customers by the year 2010 and a 100% reduction by 2015, except where justifiable by differences in the quality of discharge in the case of sewerage and treatment tariffs."

These last three items parallel the reform recommendations of Morris and Kis (2004). We believe that they reflect the EBRD conviction that their investment in a water system is best protected when the system is operated in an economically efficient manner. This means controlling costs, establishing clear and business-like arrangements with customers – even owner-customers like the City of Karlovac – and pricing services in a way that matches tariffs with the full costs of providing services to particular customer segments. We expect that the FOPIP will elaborate specific management and operating reforms that will control costs e.g., to more fully utilize the labor-saving opportunities provided by the SCADA system.

4.1.3. Croatian Waters and Central Government Grants and Privileges

ViK Karlovac believes that, in undertaking this investment program, it is taking on financial responsibilities to meet service and effluent control targets that are in the interest of the central government. This being the case, it also believes that it is entitled to some relief from the payment of fees to Croatian Waters. Such relief would reduce the tariff burden on local customers. ViK Karlovac and the City of Karlovac are discussing the possibility of such a concession with CW and other representatives of the Central Government. There has been an agreement in principle that some rebate of CW fees is appropriate, but the size and other terms of the rebate have not yet been determined.

4.2. Cost Reduction

The direct cost of the investment program and the indirect cost of meeting additional conditions tied to external funding and associated increases in operating costs, means that ViK Karlovac must press to actively look for ways to become more efficient: to reduce costs without reducing service levels. The FOPIP study is a step in this direction. While it is generally believed that the FOPIP will be able to identify ways to substantially improve ViK Karlovac efficiency, it is not clear how aggressively FOPIP recommendations will be implemented or how large any cost savings will be.

We anticipate that in addition to proposing actual cost saving measures the FOPIP program would likely include:

- a service agreement with the City of Karlovac,
- an improved billing system, and

> improvements in cost accounting to support association of specific costs with particular service users and investment projects.

4.3. Revenue Enhancement

4.3.1. Tariff Increases

ViK Karlovac has already increased tariffs substantially from 2000-2006 (see 0). These tariffs were increased to cover the continuing costs of some network expansion and repair, the coverage of administrative and "non-eligible" costs connected with the ISPA investment program, and the payment of origination fees on the EBRD loan. The expectation on the part of ViK Karlovac, the City of Karlovac, and ViK Karlovac customers is that tariffs will go up still more in the future. There are two key and interrelated concerns: that the tariff increases be "reasonable" and in keeping with the expectations of customers and City officials.

Recently Karlovac also introduced a reform that had the effect of increasing tariffs for a select group of customers. A review of account and billing data showed that seventeen legal entities, mainly public institutions with total annual water consumption of about 27,000 m^3, were paying for services at the lower, household consumption charge rather than the commercial/industrial rate. The difference is substantial – for water service the commercial/industrial tariff is 3.6 times larger than the household tariff. ViK Karlovac has put all these customers on the appropriate tariff in March 2006.

4.3.1.1. Cost-Based Tariffs

ViK Karlovac continues to expect to base tariffs on its cost of providing services. Tariffs are expected to increase to cover interest and principal of the loan as these costs are added to the system beginning in 2008. It also anticipates raising tariffs to provide income necessary to pay for increased operating costs associated with the ISPA supported investment program, most particularly the cost of operating the WWTP but also including possible system maintenance and pumping costs that may only be identified during detailed design of networks and facilities.[10]

4.3.1.2. Cost-Reflective Tariffs

ViK Karlovac plans that tariffs of households and industries will be "converged" over time to reduce the current cross-subsidy from commercial/industrial customers. ViK Karlovac recognizes, however, that not all tariff differences between customers are unjustified. In particular, ViK Karlovac wants to be sure that customers that are more expensive to service, for whatever reason, have a tariff that reflects that higher cost.

This consideration has led ViK Karlovac to consider adoption of a fixed tariff component of its tariff structure. Some customers use only a small amount of water but this small and intermittent service depends on the availability of the entire network on a continuous basis. Introduction of a

[10] An uncertain cost element involves planning for retention systems to hold the "first flush" combination of sewerage and storm water that will have to be handled. The WWTP capacity will not be large enough to handle the sudden load associated with large rain storms or snowmelt and, to protect the plant, some of this water must be allowed to by-pass the WWTP and enter one or the other rivers once the first rush of water with the highest concentration of sewerage is retained for future treatment.

fixed tariff component would be a way of recognizing this aspect of ViK Karlovac's cost structure and spreading fixed costs more evenly across customers.

In the same spirit, ViK Karlovac is also considering moving toward cost-of-service based tariffs for different customer categories based on their different service requirements. For example, wastewater tariffs may vary with the concentration of pollutants or water tariffs may be higher for more remote communities that join the system but require longer network connections and greater energy to provide service.

5. ASTEC ANALYSES OF CURRENT AND PROSPECTIVE REFORMS

The Accounts Simulation for Tariffs and Effluent Charges (ASTEC) spreadsheet model was designed to examine the interaction of a MWWU's service prices with investment strategies, cost structures, customer behavior and physical conditions. It does this by developing a baseline set of accounts – physical accounts of water system flows, cost and revenue accounts for the water system and its services, and expenditure accounts for customer groups – and then applying scenarios to the baseline that vary investments, tariffs, collection programs, and representations of a wide variety of other policies. For example, if a new investment is undertaken, ASTEC will compute an new set of water or wastewater rates that will just cover the additional costs (and cost savings) associated with this investment. ASTEC can also explore the effects of policy changes e.g., new billing and collection strategies, introduction of a fixed charge into the tariff structure. It is well-suited to examining the financial and operational implications of tariff and related reforms for municipal water systems e.g., new billing and collection strategies, introduction of a fixed charge into the tariff structure.

The scenarios fall into two broad categories: baseline or current conditions and; prospective or future scenarios that examine what is likely to happen under a future set of polices. ASTEC explores the implications of these scenarios for both water system finances and customer budgets. This section introduces the baseline ASTEC scenario data used to characterize Karlovac and briefly describes the data used to construct prospective or future scenarios.

5.1. ViK Karlovac ASTEC Baseline Scenario

The following sections describe and document the baseline scenario and its data.

5.1.1. Service User Categories

Service users of ViK Karlovac are differentiated based on the following features:

The Services Received. Service users are distinguished by whether they receive only water service or both water and sewage service.[11]

Consumption. A threshold of 5 m^3/month on average, equivalent to 60 m^3/year was chosen to distinguish between service users with low and high levels of consumption. This organizing feature is important because service users with low consumption generate relatively little revenue for ViK Karlovac since all tariff payments are presently based on consumption.

Households and Industrial/Commercial. Households currently pay substantially lower tariffs than industrial, commercial, and public entities. These latter are all referred to as "industrial" consumers.

[11] ViK has just begun collecting the wastewater of Duga Resa, an adjacent community, on its wastewater network. Duga Resa and ViK are discussing service terms and conditions for the future but ViK does not expect to receive any revenue from Duga Resa residents or commercial enterprises in return for this service in 2006.

Revenue Collection. ViK Karlovac revenue is usually collected by Inkassator but, in the case of a few larger customers, it is collected directly by ViK Karlovac.

Individual Account Metering. –Customers that have their own meter have a greater incentive to reduce consumption.

Special Considerations. Industrial facilities with high consumption appear in service user categories "Industry H" and "Industry I". Three large companies, namely Karlovacko Brewery, Kim (a milk producer) and PPK (a meat factory), however, have been assigned to separate categories. The brewery is handled separately because it is the single largest customer of ViK Karlovac, with prompt payments of water and wastewater bills, and with a strategic need for high quality drinking water for the production of beer. The other two companies are large consumers which are not connected to the sewer at present, but ViK Karlovac's expectation is that they will be connected after the planned sewer extension is finished.

Table 5 below contains a listing of the Customer Categories selected to represent ViK Karlovac in the ASTEC model.

Table 5 Service User Categories of ViK Karlovac with Estimated 2006 Consumption Data

	Service User Category	Service	Consumption per Account	Tariff in 2006	Revenue Collection by	Number of Accounts	Invoiced Water Consumption per Account (m^3/year)	Invoiced Wastewater Discharge per Account (m^3/year)
1	Households A, in big apartment buildings	W + S*	High	Low	Inkassator**	15,589	92	92
2	Households B	W + S	High	Low	Inkassator	1,435	111	111
3	Households C	W + S	Low	Low	Inkassator	4,379	37	37
4	Households D	Water	High	Low	Inkassator	9,868	111	0
5	Households E	Water	Low	Low	Inkassator	810	18	0
6	Industry A, Brewery	W + S	High	High	ViK	1	525,680	525,680
7	Industry B, PPK and Kim	Water	High	High	ViK	2	86,083	0
8	Industry C, former low price	W + S	High	Low	ViK	17	1,550	1,427
9	Industry D	Water	Low	High	Split***	62	22	0
10	Industry E	Water	High	High	Inkassator	35	569	0
11	Industry F	W + S	Low	High	Split***	476	26	26
12	Industry G	W + S	High	High	Inkassator	189	234	234
13	Industry H	Water	High	High	ViK	82	1,958	0
14	Industry I	W + S	High	High	ViK	306	2,641	2,641
15	Duga Resa	Sewage				1	0	250,000
	Total					33,252	4,638,527	3,422,431

*W + S refers to Water and Sewage. ** Billing contractor to ViK Karlovac. *** Some accounts are collected by ViK Karlovac, others by Inkassator

There are two sources of consumption data in 0. There are good quality records for the 2006 accounts, and account consumption of those – mainly industrial – customers whose revenue is collected directly by ViK Karlovac. These data are based on the first nine months of 2006 with a

seasonal adjustment based on 2005 data. The account and consumption data for other customer categories – those whose revenue is collected by Inkassator - had to be estimated based on consumption for just the first nine months of 2006 and scaled by 12/9ths for the full year. No seasonal adjustment could be made because all Inkassator billing data from 2005 and earlier has been reported lost by Inkassator. Invoiced wastewater discharge is computed as 100% of water consumption for all customers which are connected to the sewer. Information on actual wastewater discharge is not available, but these are believed to be very close to invoiced quantities in most cases. As noted above, the Karlovacko brewery contends that it discharges only a small fraction of the water it uses as wastewater.

5.1.2. Produced, Billed, and Unbilled Water

2006 water production by ViK Karlovac is estimated to be 8.939 million m^3. Unbilled water is defined as the difference between produced water and billed water quantities. In 2006 it is estimated to be 48% of produced water or 4.3 million m^3. Unbilled water in the case of ViK Karlovac may be regarded as having two components: leakage from the water system, and water consumed but not billed ("other than leakage").

5.1.2.1. Leakage

Leakage is defined as the actual loss of water from the distribution network due to leakage from the network. While ViK Karlovac believes that most unbilled water is leakage, a reliable estimate for leakage is not available. With planned investments in flow meters and consumption meters it will be possible to more accurately determine the actual level of leakage, broken down to segments of the network, as well as the level of presently unbilled, but consumed water.

5.1.2.2. Other than Leakage

The rest of the water produced but not billed is mostly comprised of unbilled consumption. This includes water used by the fire department and the city park service; any illegal consumption by unauthorized persons or organizations; and water used for technical purposes by ViK Karlovac, such as flushing the networks to keep them clean.

5.1.3. Wastewater, Infiltration and Storm Water

Total annual discharge of water through the ViK Karlovac sewer network, including all wastewater collection, storm water and infiltration, is estimated to be about 5.109 million m^3 in 2006. This estimate is based on water consumption, periodic sampling of wastewater flows, and crude estimates of storm water flows size and frequency. The estimated wastewater discharge from ViK Karlovac customers is estimated to be 2.977 million m^3/year. Infiltration in 2006 is estimated to be 1.042 million m^3/year or about 35% of wastewater discharged, with the balance of estimated sewerage network flows attributed to storm water collected by the combined system. Invoiced wastewater discharge is 3.172 million m^3/year, reflecting both the ViK Karlovac practice of charging for wastewater service based on water consumption and the current absence of any charge for handling Duga Resa wastewater.

5.1.4. Revenues

Baseline revenues are calculated as the product of billed quantities times the tariff on each of those quantities less estimates of non-payment. The following describes the baseline data that support these revenue calculations.

5.1.4.1. Tariffs

While 2005 passed without a change in tariffs, a substantial increase took place as of 1 March 2006, especially for wastewater services. The newly effective tariffs are contained in the 0 below. In the spirit of gradually decreasing the gap between household and industrial tariffs, household tariffs were increased by a higher percentage than industrial tariffs. Despite this, the absolute difference between the household and industrial tariffs further increased in 2006.

In addition, seventeen public entities, which formerly paid household tariffs, were charged the higher, industrial tariffs. The overall impact of this latter change on ViK Karlovac revenues is about 150 thousand HRK; small but not trivial. According to ViK Karlovac management re-categorization of the tariffs for these customers is a matter of principle ("no exceptions"). One exemption, from this change, however, is the Karlovac home of the elderly people. While this customer is a legal, commercial entity, the service users are viewed as households.[12]

Table 6 Change of Water and Wastewater Tariffs as of 1 March 2006 (HRK/m³)

Tariff Type and Time Interval	Water tariff	Wastewater tariff	Value Added Tax (22% of tariffs)	Croatian Waters fee for water services	Croatian Waters fee for wastewater services	Total
Household tariffs before 1 March 2006	2.41	1.14	0.78	0.80	0.90	*6.03*
Household tariffs after 1 March 2006	2.75	2.25	1.10	0.80	0.90	*7.80*
Percentage change of household tariffs	14%	97%	41%	0%	0%	*29%*
Industrial tariffs before 1 March 2006	7.83	2.11	2.18	0.80	0.90	*13.82*
Industrial tariffs after 1 March 2006	8.63	4.15	2.81	0.80	0.90	*17.29*
Percentage change of industrial tariffs	10%	97%	29%	0%	0%	*25%*

5.1.4.2. Price Elasticity of Demand

Elasticity of demand is an estimate of the percentage change in consumption that results from a one percent increase in the price of the good or service. For instance, if the elasticity of demand for water consumption is –0.2 then one percent increase in the price of water triggers a 0.2 percent

[12] This situation nicely illustrates the problem often encountered when tariffs are set to allow one group of customers to cross-subsidize another group. In this example, mental institutions, convents, prisons, boarding schools, etc. can also claim to directly serve resident households. This will become a non-issue for ViK as it moves to "converge" tariffs and establishes the principle of cost-based tariffs in general.

decline in water consumption relative to the baseline level.[13] When a customer consumes both water and wastewater services and the consumption of the two services cannot be decoupled from each other, i.e. sewage discharge, and consequently, the wastewater bill is determined by water consumption, then the price change of both services together need to be considered.

If a dependable time series of water consumption and service price data is available, then the elasticity of demand can be calculated for a given locality. In Karlovac this is not the case. Therefore we estimated the values of elasticity of demand for Karlovac service users based on local features of consumption and empirical evidence from other municipalities. In developing these estimates we were most influenced by the fact that water consumption was already modest for individually metered households and that industrial and commercial customers already pay pretty high tariffs for water and wastewater service (See Section 2, Appendix B). The baseline elasticity estimates we used are listed in Table 7. No baseline elasticity estimate has been produced for the Duga Resa customer category since it is not yet being charged for the service.

Table 7 Values of Elasticity of Demand Used for Modeling

Service User Category Number	Service User Category	Elasticity of Demand for Water and Wastewater Service
1	Households A, in big apartment buildings	-0.1
2-5	Households B Households C Households D Households E	-0.15
6-14	Industry A, Karlovacko Brewery Industry B, PPK and Kim Industry C, former low price Industry D Industry E Industry F Industry G Industry H Industry I	-0.1
15	Duga Resa	-

5.1.4.3. Revenue Estimates

In addition to revenues from water and wastewater tariffs, ViK Karlovac receives revenues from other services, such as construction activities; maintenance of city fountains, gullies, underground tunnels; collecting of CW fees; cleaning of septic tanks and blockages, and "connect" charges[14].

[13] Traditionally economists drop the negative sign from elasticity of demand measures because price and quantity demanded always move inversely. Here we retain the sign to prevent possible confusion for the general reader.

[14] A connect charge, which is supposed to contribute to network development costs, is paid by customers to the City of Karlovac. In case of water service, the connect charge is 2,000 HRK/apartment, 3,000 HRK for a building with 2 or 3 apartments, and 4,000 HRK for buildings with more than 3 apartments. Commercial entities pay a connect charge based on the area of their property. The wastewater service connect charge paid to the city is 1,000 HRK/connection for households, and it is determined based on the size of the property for legal entities. All newly connected service users pay ViK HRK 500 after each water connection in the form of an "inspection fee". In case of new wastewater connections, ViK gets reimbursed for any related work it needs to do. For new household connections, this cost is around 3,000-4,000 HRK a piece. For commercial enterprises the level of the cost substantially varies with the size of the work.

Revenues from these services amounted to HRK 3.106 million in 2005. Revenues from the same sources in 2006 are expected to be much lower, at around HRK 1.15 million. This is due primarily to 1) using the construction equipment and labor of ViK Karlovac for internal purposes as opposed to renting it to other businesses and 2) lower overall revenues from the city. The composition of total revenues as represented in the Baseline is contained in the table below.

Table 8 Total Revenues of ViK Karlovac in 2006 as Represented in ASTEC Baseline Data

Source of revenue	Million HRK	Revenue Sources (%)
Water Service	22.144*	64.2
Wastewater Service	9.362*	27.1
Transfer from the municipality of Karlovac in connection with the purchase of the site of the WWTP	0.734	2.1
Other revenues (services to the city, other services, compensation from Croatian Waters for collection of the CW water and wastewater fees)	2.268	6.6
	34.508	100.00

* Does not include correction for non-payment.

Besides its own revenues, ViK Karlovac and Inkassator also collect the water and wastewater fees for Croatia Waters. The level of these fees per m^3 of water or wastewater billed is displayed in 0 above. The level of the Croatia Waters fees did not change in 2005 or 2006, and VAT is not imposed upon them. The Croatia Waters fees collected by ViK Karlovac and Inkassator do not appear in the books of ViK Karlovac, as they are kept on a special account from where they are transferred directly to Croatia Waters. Twenty five industrial facilities that receive service from ViK Karlovac pay wastewater fees directly to Croatia. The size of these payments is unknown to ViK Karlovac.

While Croatia Waters fees do not appear in the books of ViK Karlovac, we consider them when calculating the burden falling on customers of ViK Karlovac. Likewise, for the same purpose VAT is added on top of water and wastewater bills in the case of households, which, unlike legal entities, cannot reclaim VAT. Neither Croatia Waters fees, nor VAT, appear in either the ASTEC accounts or the internal books of ViK Karlovac.

5.1.4.4. Non-Payment or Delay in Payment

A minority of service users pay their water and wastewater bills with some delay, and a few do not pay it at all. Recently revenues that are never collected have been estimated by the accounting staff of ViK Karlovac to be around 4-5% of billed amounts. Unfortunately, detailed historic records of non-payment are not available. Large customers from whom ViK Karlovac collects directly have been paying promptly or with short delays in recent years. Inkassator provides only aggregate information on non-payment from the customers from whom it collects bills for water and wastewater service.

The percentage of unpaid bills used for 2006 baseline data was estimated based upon consumption data, which serves as the basis of billing, and the amount of money actually received by ViK Karlovac in 2005. These results are inherently imprecise, as it is not possible to clearly distinguish between delayed and unpaid bills. Furthermore, some of the bills issued in a given year are only paid in the subsequent year and are registered then as current revenues.

Table 9 provides resulting estimates of unpaid bills by each service user category for 2006. Customers in industrial service user categories G and I, mostly mid-sized industrial facilities, appear to have the poorest record of payment.

Table 9 Estimated Consumption of Services and Payment of Bills in 2006

	Service User Category	Billed Water Consumption (m^3/year)	Billed wastewater Discharge (m^3/year)	Estimated Ratio of Unpaid Water and Wastewater Bills	Estimated Collected Revenue from Water Service (HRK/year) *	Estimated Collected Revenue from Wastewater Service (HRK/year) *	Unpaid Water Bills (HRK/year) *	Unpaid Wastewater Bills (HRK/year) *
1	Households A, in big apartment buildings	1 436 418	1 436 418	5.0%	3 752 641	3 070 343	197 507	161 597
2	Households B	159 260	159 260	5.0%	416 066	340 418	21 898	17 917
3	Households C	161 823	161 823	5.0%	422 761	345 896	22 251	18 205
4	Households D	1 095 372	0	5.0%	2 861 660	0	150 614	0
5	Households E	14 628	0	5.0%	38 215	0	2 011	0
6	Industry A, Brewery	525 680	525 680	0.0%	4 536 616	2 181 571	0	0
7	Industry B, PPK and Kim	172 166	0	2.5%	1 448 651	0	37 145	0
8	Industry C, former low price	26 346	24 265	0.0%	227 368	100 699	0	0
9	Industry D	1 373	0	2.5%	11 554	0	296	0
10	Industry E	19 928	0	2.5%	167 678	0	4 299	0
11	Industry F	12 564	12 564	2.5%	105 715	50 836	2 711	1 303
12	Industry G	44 272	44 272	7.5%	353 411	169 948	28 655	13 780
13	Industry H	160 547	0	2.5%	1 350 879	0	34 638	0
14	Industry I	808 151	808 151	7.5%	6 451 268	3 102 290	523 076	251 537
15	Duga Resa	0	250 000	-	0	0	0	0
	Total	4 638 527	3 422 431	4.73% **	22 144 483	9 362 001	1 025 101	464 339

* Excluding VAT and Croatian Waters fees. ** Average figure

5.1.5. Costs

ASTEC cost formatting requires that cost data be divided, first, into water and wastewater related costs and, second, into fixed and variable costs. We have done this for ViK Karlovac and the results are described below. The basis for these divisions depends on the purpose and time frame of the modeling exercise. In this instance, we used the ViK Karlovac Accounting Department's division of costs into water and wastewater costs as the basis for this allocation. For division into fixed and variable costs we have chosen to apply the following criterion in the baseline: a cost will be treated as a fixed cost if it does not vary as we increase or decrease water consumption or wastewater handled by some small amount. This is a very "short run" criterion, one that we feel is appropriate to allocating costs in the baseline and one that we can and should modify as we develop scenarios for future operations and more possibilities for substitution of inputs as ViK Karlovac adjusts to new policies and service levels.

5.1.5.1. Initial 2006 Cost Estimation and Allocation

Since cost data for 2006 were only available for the first nine months of 2006 when we developed the ASTEC baseline scenario data, first we scaled the first three quarters of financial information to the whole of 2006. The cost information thus derived was then broken down into water and wastewater costs, and fixed and variable costs based upon the structure of 2005 cost data. Exceptions to this method included the allocation of the fixed and variable costs of materials and energy, where specific features of 2006 were used to make this allocation. Additionally, loan repayments estimates were based on actual and anticipated payments in 2006. These data, and their division in to water and wastewater costs and, then, into fixed and variable costs, are shown in Table 10 below.[15] The table includes main cost categories, which are fairly standard and conform to the way the ViK Karlovac Accounting Department organizes cost accounts.

Total costs of ViK Karlovac in 2006 for water and wastewater operations were estimated to be HRK 34,975 thousand. Under our rule for allocation of fixed and variable costs, nearly ninety percent of the 2006 costs are fixed and over sixty eight percent of the costs are fixed water service costs. Labor costs represent the single biggest cost item: gross salary and the tax on salaries adding up to just under 40% of all costs.

Table 10 Estimated 2006 Costs of ViK Karlovac (thousand HRK)

Cost item	Water service		Wastewater service		Total costs	Share in total cost
	Fixed costs	Variable costs	Fixed costs	Variable costs		
Material	2,007	84	308	0	2400	6.5%
Energy	605	1220	311	164	2300	6.3%
Small parts, tools	154	0	46	0	200	0.5%
Telephone	201	0	59	0	260	0.7%
Transportation	0	0	0	0	0	0.0%
Maintenance, repair	949	0	192	0	1140	3.1%
Local taxes, service charges	408	0	292	0	700	1.9%
Depreciation	7019	0	2 280	0	9300	25.3%
Transportation, fee for out-of-city trips etc.	731	0	220	0	950	2.6%
Medical examination	73	0	22	0	95	0.3%
Representation	114	0	86	0	200	0.5%
Insurance	309	0	91	0	400	1.1%
Sport and recreation	60	0	60	0	120	0.3%
Tax and concession fee payments	181	315	54	0	550	1.5%
Bank charges	54	0	16	0	70	0.2%
Employee bonuses	463	0	137	0	600	1.6%
Non-production services, incl. Inkassator	353	1036	105	306	1800	4.9%

[15] ASTEC can also allocated particular costs to each service user category. ViK accounting data are not kept in a way that allows such cost allocation, so as a default costs in ASTEC were allocated to each service user category based on the amount of water consumed or wastewater service billed. This allocation is arbitrary but not totally unwarranted since costs and water consumption are highly correlated. This procedure only becomes an issue if the user wants to run an ASTEC scenario in which there are significant differences in the costs of providing service to different service user categories that are not related to consumption and ASTEC is asked to calculate specific tariffs for each service user category based on recovering the costs of serving each service user category. A variation of this tariff computation feature of ASTEC allows the user to combine subsets of service user categories and their allocated costs for the calculation of tariffs.

Cost item	Water service		Wastewater service		Total costs	Share in total cost
	Fixed costs	Variable costs	Fixed costs	Variable costs		
Gross salary	8729	459	2658	54	11 900	32.4%
Tax on salaries	1460	77	445	9	1990	5.4%
Repayment of principle on loans	163	0	1244	0	1408	3.8%
Repayment of interest on loans	85	0	256	0	341	0.9%
Total cost	23872	3192	7378	534	34975	100%

While depreciation is entered as a cost here, it is the only cost item that does not involve actual cash flow outlays in this period. In principle, depreciation represents the wear and tear on capital equipment and long-lived infrastructure used to produce water and wastewater services at ViK Karlovac. The link between this concept and the entered value used in ViK Karlovac books is tenuous. The book value is determined by accounting and tax conventions with only weak links to any formal, market-based assessments of changes in the value of ViK Karlovac capital equipment and infrastructure with the passage of time and use. This is not a trivial matter: depreciation in 2006 accounts for HRK 9.3 million or over one-fourth of all booked costs.

What's more, the annual value of depreciation grew by more than one-third between 2005 and 2006. The reason for this large increase is that 2006 is the first year in which a couple of long term, large-scale investments - including the South Collector sewer serving Duga Resa - can legally be depreciated. There was also a legal change that allowed an increase in the amount of depreciation taken on existing assets. We will discuss this cost entry and its role in ViK Karlovac finances in the following sections.

5.1.5.2. Investment Activity

Table 11 below reviews all the major investment projects carried out by ViK Karlovac during the last 11 years. About twice as much was spent on wastewater as on water infrastructure, and the South Collector makes up almost half of all wastewater related investments. Fifty-seven percent of the total investment cost was financed from Croatia Waters grants, and another seventeen percent from City of Karlovac grant contributions. Only one-quarter of the financing burden, equivalent to HRK 20 million, fell on ViK Karlovac. Of this amount, only about HRK 1 million was financed by a commercial loan. The rest of the investment came from the cash balances ViK Karlovac.

Table 11 Major Investment Projects of ViK Karlovac Between 1995 and 2005

Name of the project	Timing	Total cost (1000 HRK)	Proportion of Financing			Financing (1000 HRK)		
			Croatian Waters grant	City of Karlovac grant	ViK Karlovac	Croatian Waters grant	City of Karlovac grant	ViK Karlovac
Rečica-Šišljavić	1995-1998	11 199	70.00%	22.50%	7.50%	7 840	2 520	840
Vodovod Draganić	1996	121			100.00%	0	0	121
Vodovod Jelsa	1997-2000	1 297	50.00%		50.00%	649	0	649
Vodovod Priselci	1997	83			100.00%	0	0	83
Vodov.mreža desne ob.Korane	1999	871	50.00%		50.00%	436	0	436
Vodov.mreža Pokupska dolina	1999-2002	6 506	37.50%		62.50%	2 440	0	4 067
Telemetrija vodovoda	2000-2004	941			100.00%	0	0	941

Name of the project	Timing	Total cost (1000 HRK)	Proportion of Financing			Financing (1000 HRK)		
			Croatian Waters grant	City of Karlovac grant	ViK Karlovac	Croatian Waters grant	City of Karlovac grant	ViK Karlovac
Vodovodna mreža Pokupska dolina II faza	2003-2005	3 866	80.00%		20.00%	3 093	0	773
Sifon Kupa	2003	620	50.00%		50.00%	310	0	310
Vodoopskrbni cjevovod Korzo	2003-2004	420	62.50%		37.50%	262	0	157
Trafostanica Borlin	2005	814	50.00%		50.00%	407	0	407
Total Water Investment		26 737	57.73%	9.42%	32.85%	15 435	2 520	8 782
Kolektor Drežnik	1995-1998	2 774	57.00%	36.00%	7.00%	1 581	999	194
Južni kolektor	1996-2005	25 207	80.00%		20.00%	20 166	0	5 041
Kolektor Grabrik	1995	2 567	100.00%		0.00%	2 567	0	0
Kolektor M.Hrvatska	1999-2000	1 785	38.00%		62.00%	678	0	1 107
Kanaliz. u ul.I.G.Kovačića	1999	2 638	38.00%	57.10%	4.90%	1 003	1 506	129
Kan.mreža desne ob.Korane	1999	714	50.00%		50.00%	357	0	357
Sanacija kolektora Matica-Korzo	2002	554	0.00%		100.00%	0	0	554
Sifon Korana	2003-2005	2 541	31.70%	60.90%	7.40%	806	1 548	188
Rekonstrukcija kolektora M.Krleže	2003	3 854	22.83%	55.00%	22.17%	880	2 120	854
Kolektor Korzo	2003-2005	9 424	21.70%	55.00%	23.30%	2 045	5 183	2 196
Kolektor u ul. J.Kraš	2004-2005	1 576	42.00%		58.00%	662	0	914
Total Wastewater Investment		53 634	57.32%	21.17%	21.51%	30 744	11 356	11 535
Total Investment		80 371	57.46%	17.26%	25.28%	46 179	13 875	20 317

5.1.6. Financial Balance

The balance between revenues and costs are termed "net revenues". In 2005 net revenues were negative; total revenues were HRK 5,068 thousand less than total costs. There was, however, one large cost item that was an "implicit" cost; depreciation equal to HRK 8,764 thousand. If we exclude depreciation from among costs, then 2005 net revenues are HRK 3,696 thousand. Essentially, these revenues were the 2005 cash balance or net operating revenues of ViK Karlovac before new investments. Most of this money was spent on investments in 2005.

This has apparently been the general practice at ViK Karlovac. The depreciation entry as a cost item justifies a tariff that exceeds the day-to-day costs of ViK Karlovac. The tariffs are set on this broader cost basis and they generate revenues that generally exceed out-of-pocket costs. But each year there are surprises – unexpected costs, revenue shortfalls, etc. The depreciation entry into the cost basis of the tariff calculation buffers ViK Karlovac from these shocks and any cash

balances that are left after surprises in costs can be earmarked for investments. In financial terms, the operating cash balances are always more or less zero at the end of the year and net revenues – exclusive of depreciation – are, likewise, zero.[16]

According to ViK Karlovac management, there are always plenty of new investment opportunities within the company (e.g. replacement of pipelines, new machinery, extension of the network) and cash balances are easily absorbed by these investments. Unfortunately, while this approach may be satisfying from an accounting point of view (current costs and revenues always balance at the end of the year), it may be unsatisfactory from an economic point of view. In particular, there is nothing in the process that assures that the investment levels and their composition assures the long term sustainability of the ViK Karlovac system or, alternately, that excessive tariffs are not being applied and over-investment isn't occurring. Perhaps even more important, this system reduces pressure to control operating costs and likely results in inefficiently high levels of operating costs while, perhaps, shortchanging the long term investment needs of the water and wastewater systems.

As an additional complication, when the City Council invests in water or wastewater infrastructure, e.g. network extension, that infrastructure is carried on the city council books. The corresponding depreciation appears there, not in the books of ViK Karlovac. This practice tilts ViK Karlovac accounts toward underestimation of the real depreciation of assets presently used by ViK Karlovac to produce services. There are, of course, influences that tilt the ViK Karlovac deprecation estimates in the opposite direction. An important management challenge is to determine what allowance ViK Karlovac should make for depreciation if one wants to support a sustainable level of service at the lowest possible cost. ASTEC can be used to help address this problem and this will be discussed further when prospective scenarios and their results are presented below. For the purpose of constructing a 2006 baseline, however, we decided it was best to represent ViK Karlovac accounts without any explicit depreciation cost but with an internal investment program that just balances estimated 2006 costs and revenues. This was done for water and wastewater costs and revenues separately and yielded the investment estimate for 2006 (see Table 12 below). An additional assumption implicit in these data is there are no external grants from CW or the City of Karlovac supporting investment activities by ViK Karlovac in 2006, or, if there are, then the estimates below represent ViK Karlovac own contributions to the investments.

Table 12 Investment Estimates for ViK Karlovac in 2006

Sector	Estimated Investment (Million HRK/year)
Water Service Investment	2.080
Wastewater Service Investment	4.161
Total Estimated Investment	6.241

This resulted in an ASTEC 2006 baseline for ViK Karlovac with virtually zero net revenues in both the water and wastewater sector. The level of investment implicit in these accounts is about four million HRK higher than the average annual investment on the part of ViK Karlovac in recent years. This suggests that 2006 tariff levels may have been set to build up current balances in anticipation of the costs of repaying the EBRD loan and meeting other financial obligations under the investment program outlined in the ISPA grant application.

[16] In principle, depreciation has an important economic function in enterprise accounts. It serves to help assure that the enterprise is sustainable in the long run. Our handling of depreciation is in no way meant to diminish or ignore this important function. In Section 3 we discuss the importance of the depreciation concept and in Section 0 we recommend steps that ViK Karlovac should take to assure that its economic depreciation values are accurate and up-to-date and included as part of long term planning by the water system.

5.1.7. Calibration

The way we have chosen to construct the Baseline ASTEC model for ViK Karlovac is essentially self calibrating. Tariffs, production, and consumption are based on 2006 data and revenues for water and wastewater service, after allowance for non-payment, should be close to those tallied in ViK Karlovac's 2006 accounts. Similarly, costs – with the exception of depreciation and investment - are based on 2006 experience to date and scaled to the year as a whole. Depreciation estimates are dropped as cost items for the reasons cited above.

The baseline ASTEC financial accounts are balanced with 2006 data by assuming investments – in the amount of 2.080 million HRK for water and 4.161 million for wastewater – are sufficient to just offset the net revenues produced by the tariffs instituted in March, 2006. The way they were estimated, is that the ASTEC model was run without investment and net revenues, after non-payment, were computed for water and wastewater services. These amounts were then added as investment in the respective sectors and the result is a financial balance in the baseline.

5.1.8. Burden Estimates

Burden indices provide a broad sense of how burdensome investment, tariff, or financing policies will be to water system customers. Burden indices are usually computed as a percentage ratio of expenditures on the service to some measure of budget or disposable income. We computed burden indices for three different customer types based on data from two household customer categories for this analysis. These results are summarized below. A more detailed discussion of burden indices used here, along with a review of their serious shortcomings in principle and practice, is contained in Section 4.

Table 13 2006 Baseline Household Burden Estimates of ViK Karlovac Water and Wastewater Service

Customer	Service User Category	Estimated Expenditure (HRK/month)	Budget Estimate (HRK/month)	Burden Estimate (%)	Remarks
More affluent family with average income	Household B: individually metered system with water and wastewater service	72	5323	1.29	Budget based on mean household net income data for Karlovac.
Family residing in an apartment with median income	Household A: jointly metered system with water and wastewater service	60	4637	1.29	Budget based on estimated median net income using historic distribution of wages in Karlovac
Pensioner	Water consumption estimated at half the consumption of Household A	30	1974	1.52	Budget based on full pension payment.

5.2. Prospective Scenarios

We have developed two prospective scenarios in ASTEC for ViK Karlovac: the 2008 and 2010 "core" scenarios. We call these two scenarios core scenarios because they represent our expectations for the future given current policies and conditions of ViK Karlovac; including tariff, financing, and other management reforms. In the next section of this report we will also discuss variations on these core scenarios given different assumptions about the future.

5.2.1. 2008 Core Scenario

As the name itself suggests, the 2008 core scenario forecasts system operating and financial conditions in 2008. This scenario assumes no change in physical infrastructure relative to the 2006 Baseline, but it incorporates several changes in ViK Karlovac financial conditions. It assumes, in addition to 2006 conditions:

- amortization of the EBRD loan has started;
- half of the Croatia Waters wastewater fees paid by ViK Karlovac customers are returned to ViK Karlovac for use in financing the investment program;
- the variable tariff on water for households is increased by twenty percent while that for industry was not increased;
- the variable tariff on wastewater for households was increased by fifty five percent but industrial tariffs were increased by eighteen percent;
- a small fixed water tariff is introduced for all water customers;
- Duga Resa household customers would pay the same tariff as Karlovac households, Duga Resa industrial customers would pay the same as industry in Karlovac, resulting in a weighted average variable tariff for wastewater service for Duga Resa within ASTEC; and
- the City of Karlovac substantially increases its payment to offset the cost of financing the land acquisition for the proposed WWTP.

The tariffs adopted in this core scenario are based on current tariff policies of ViK Karlovac. The tariffs:

- reduce the gap between the variable tariffs currently paid by households and industrial customers;
- are no higher than necessary to roughly cover system operating costs plus provide net revenues for replacement, new investments, and amortization of the EBRD loan; and
- continue to provide some cross-subsidy from water services to wastewater services.

The tariffs for the 2008 core scenario were computed by trail and error with the condition that they meet these criteria. This got a little tricky since changes in tariff also change consumption and costs in non-linear ways. There are, of course, many other combinations of tariffs that would also meet the above criteria. We do not contend that the combination we offer here are "best", only that they are representative of tariff levels compatible with current tariff policy and 2008 technical and financial conditions. Alternative tariff combinations all involve trading of one criterion against the other e.g., greater reduction in the gap between household and industry tariffs means raising the household tariff still higher.

For Duga Resa, the wastewater tariff applied use the ViK Karlovac wastewater tariffs with industrial and household tariffs weighted by 1/3 and 2/3 respectively. This scenario also assumed that ViK Karlovac did not provide Duga Resa's water services.

While ViK Karlovac generally follows the practice of using the net financial balances for investment purposes in any given year, the company also occasionally uses commercial bank loans to initiate larger projects. These loans are paid for using future cash balances and the cost of the loans is added to the cost-basis for computation of future tariff requirements.

A new water main and some related, secondary networks were built in the district of Pokupska Dolina between 2000 and 2002 for a total investment cost of HRK 6.5 million. 37.5% of this investment was financed by a Croatia Waters grant, the rest was paid for by ViK Karlovac, partly through a HRK 1,397,000 loan from Hypo Bank. In 2006 the principle and interest payment on this loan by ViK Karlovac is about HRK 248,000. Annual amortization payments of similar magnitude will take place until 2011.

Two major commercial loans were obtained by ViK Karlovac during 2005 and 2006. Both of them supported the purchase of land for the site of the proposed WWTP. As the land purchase is considered by the ISPA grantees as a "non-eligible" cost in this instance, ViK Karlovac had to finance the purchase internally until the City of Karlovac fulfilled its pledge to reimburse the majority of these land acquisition costs to ViK Karlovac over the next six years. In this sense, the loans were needed to bridge the time gap between the purchase of the land and the transfer of funds for the purchase from the City.

The Table 14 below summarizes the amortization of the commercial loans taken by ViK Karlovac, as well as the money transfer from the municipality of Karlovac to ViK Karlovac in relation to the land purchase. These data were used in computing costs in both the 2008 and 2010 core scenarios.

Table 14 Cash flows between 2006 and 2011 related to the commercial loans taken by ViK Karlovac

Year	Amortization of the commercial loans taken by ViK Karlovac (HRK, estimated values except for 2006)			Reimbursement from the city – land purchase of the WWTP
	Hypobank loan in relation to the water network	HBOR loan – land purchase for the WWTP	Privredna Banka Zagreb loan - land purchase for the WWTP	
2006	248 000	1 500 000		734 485
2007	248 000	1 460 000		1 460 000
2008	248 000	1 460 000	1 250 000	2 630 000
2009	248 000	1 460 000	1 250 000	2 630 000
2010	248 000		1 250 000	1 170 000
2011	248 000		1 250 000	1 170 000
Total	1 488 000	5 880 000	5 000 000	9 794 485

5.2.2. 2010 Core Scenario

The 2010 core scenario reflects anticipated conditions after completion of the new WWTP. Consequently, while the 2010 scenario still bears most of the features of the 2008 scenario, it also has the following additional costs:

- annual EBRD loan amortization is 400,000 HRK higher in 2010 in order cover amortization of the principal,
- half of the Croatia Water wastewater fees are still returned to ViK to help amortization of the EBRD loan, but the unit fee is now only 0.2 HRK/m3 due to high level of wastewater treatment, and
- the WWTP added 3.6 HRK/m3 of operating costs to wastewater service costs.

In addition, the 2010 core scenario reflects the assumption that some of the other policies of ViK Karlovac have changed features of the system. As a result of the ISPA investment program, unbilled water is reduced by 5% in 2010. Furthermore, six hundred additional households have been connected to the ViK Karlovac the sewer network (600 more accounts for Households B category, and 600 less for Households D category).

The gap between household and industrial variable tariffs is further reduced to only 50% of 2006 values, while variable tariffs are also increased with 50% for water and 100% for wastewater compared to 2006. Fixed water tariffs are in force.

The 2010 tariffs are substantially larger due to the cost items cited above. The variable water tariffs were, on average, increased by fifty percent relative to the 2006 baseline; for wastewater they were increased by 130% on average. The tariffs were also selected so that the gap between household and industrial variable tariffs is further reduced to only fifty percent of the gap in 2006. Fixed water tariffs are in force, just as in 2008. The evolution of variable tariffs in the core scenarios of the examined years is shown in Table 15 below.

Table 15 Change in Variable Tariffs, Taxes, and Fees Between 2006 and 2010 (HRK/m^3)

Tariff Components	Household Tariff			Industrial/Commercial Tariff		
	2006	2008	2010	2006	2008	2010
Water tariff	2.75	3.30	6.30	8.63	8.63	9.25
Wastewater tariff	2.25	3.50	6.67	4.15	4.90	7.62
VAT	1.10	1.50	2.85	0.00	0.00	0.00
CW water fee	0.80	0.80	0.80	0.80	0.80	0.80
CW wastewater fee	0.90	0.90	0.20	0.90	0.90	0.20
Total	7.80	10.00	16.82	14.48	15.23	17.87

Some particular aspects of these 2010 scenario features are elaborated below.

5.2.2.1. Operating costs of the WWTP

Detailed design of the proposed WWTP will be undertaken as part of future engineering work, so accurate operating cost estimates are not yet available. Nevertheless, for modeling purposes some estimate of these costs are needed. We used three sources in developing the WWTP operating cost estimates used in the 2010 core scenario.

1. The VIK Karlovac PIU has visited several foreign WWTPs with treatment capacity and extent similar to that envisaged for ViK Karlovac. The managers of some of these facilities have discussed the size and composition of their operating costs with the PIU staff. Since some of the unit costs, especially labor and energy, can differ significantly in different settings, these cost estimates were not directly applied but served as good benchmark for modeling purposes.

2. Tertiary treatment embraces a wide range of alternative technologies. The technology ultimately used by ViK Karlovac will be chosen by the system managers and the architect and engineering designers which win the contract to perform the work. At present we only have some of the starting points of the design at our disposal: estimates of the quality and quantity of the wastewater to be treated, and requirements on the quality of the final effluent. This information was shared with several designers at engineering companies and, based upon these data, the experts provided rough operating cost estimates for a WWTP that would meet Karlovac conditions and targets.

3. A benchmarking study sponsored by the World Bank (www.ib-net.org) assessed operating conditions at twenty two water and wastewater utilities in Hungary. One of the indicators computed was the operating cost of wastewater systems with at least secondary treatment. The operating cost estimates of these companies provided a way to crosscheck the estimates derived from by using the two methods described above.

After a review of these information sources, we selected an operating cost estimate of 0.5 €/m^3, equivalent to 3.6 HRK/m^3, as the operating cost to be used for ASTEC modeling purposes.

5.2.2.2. Fees to, and Rebates from, Croatian Waters

In the past ViK Karlovac regularly received grants from Croatia Waters as a support to its on-going investments. The value of the grants have always been lower than the water and wastewater fees paid by the consumers of ViK Karlovac to Croatia Waters, and the general view at ViK Karlovac is that in practice Croatia Waters does not provide a grant, but allows some fees to be retained for investment. This system, however, is not automatic. Water systems must apply to Croatia Waters for support and not all applications are supported. As described later in the discussion of reforms, ViK Karlovac would like to make an agreement with Croatia Waters to waive future fees to help finance repayment of the EBRD loan but in this scenario we assume that the arrangement for fee rebates remains much as it assumed in 2008 with one major exception.

According to current regulations the level of the wastewater fees paid to Croatian Waters should decrease after ViK Karlovac starts to operate its planned wastewater treatment plant, from the current 0.90 HRK/m^3 to about 0.20 HRK/m^3. Consequently, we change the size of the fee paid to CW in 2010 and, correspondingly, the size of the rebate returned to ViK Karlovac by CW. It is also worth noting that the fee structure of the regulation may change by the time the WWTP becomes operational in 2010. In fact a substantial change in the relevant decree is being discussed and may take place by the end of 2006. At present we do not have information on the nature and direction of this change.

6. RESULTS OF CURRENT AND PROSPECTIVE REFORMS: CORE SCENARIOS AND SENSITIVITY ANALYSES USING ASTEC

This section summarizes the results of using the data and assumptions for ViK Karlovac described above in the ASTEC model. ASTEC calculates the physical and financial changes occasioned by the various investment and tariff policies reflected in each of the scenarios. The new outcomes are automatically tabulated by ASTEC as summary results tables for each scenario and as set of comparative tables for examining selected results across scenarios.

6.1. Results of Core Scenarios

As shorthand, the core scenarios are abbreviated as follows: Baseline is the baseline scenario or, sometimes, S2006; S2008 is the core future scenario for 2008; and S2010 is the core future scenario for 2010.

6.1.1. Production, Consumption, and Wastewater Levels

The number of customers in each service user category was pretty much the same over each of the scenarios.[17] As investments are financed, however, and the tariffs changes and other reforms are introduced, consumption, and production that supports that consumption, are estimated to change. The resulting changes in invoiced water consumption – are shown in Table 16. The biggest percentage drops are for households that receive both water and wastewater services. In these cases, Households B and Households C, tariffs increase on both services and the effective price increase nearly doubles.

Table 16 Invoiced Water Use in the Core Scenarios for Each Service User Category

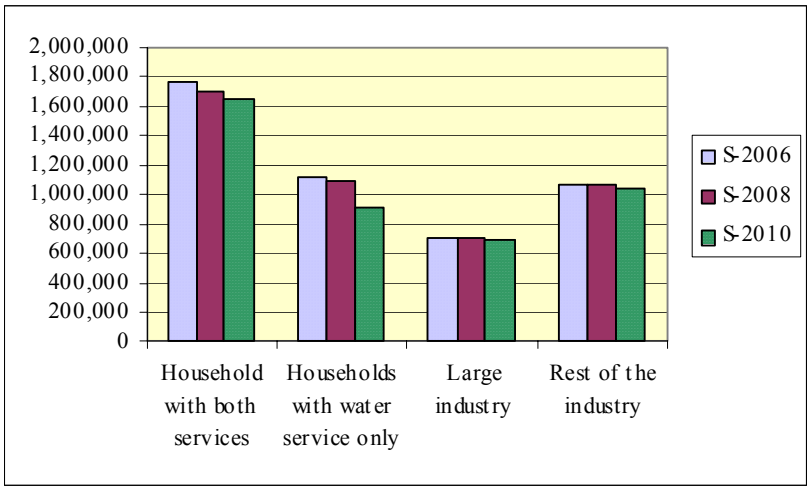
Service User Category	Average Invoiced Water Use Per Account (m^3/year/account)			Average Invoiced Water Use as a Percent of 2006 Baseline (%)	
	Baseline (S2006)	S2008	S2010	S2008	S2010
Households A, in big apartment buildings	92.1	89.4	83.8	97.0	90.9
Households B	111.0	106.0	96.2	95.5	86.7
Households C	37.0	35.3	32.0	95.5	86.7
Households D	111.0	108.0	98.0	97.3	88.3
Households E	18.1	17.6	15.9	97.3	88.3
Industry A, Brewery	525,679.7	522,673.8	511,284.7	99.4	97.3
Industry B, PPK and Kim	86,083.2	86,078.9	85,488.0	100.0	99.3
Industry C, former low price	1,549.8	1,541.4	1,508.9	99.5	97.4

[17] The exception being the shift of some customers from being strictly water customers to being customers that received both water and wastewater services from ViK Karlovac in 2010..

Service User Category	Average Invoiced Water Use Per Account (m^3/year/account)			Average Invoiced Water Use as a Percent of 2006 Baseline (%)	
	Baseline (S2006)	S2008	S2010	S2008	S2010
Industry D	22.1	22.1	22.0	100.0	99.3
Industry E	569.4	569.3	565.4	100.0	99.3
Industry F	26.4	26.2	25.7	99.4	97.3
Industry G	234.2	232.9	227.8	99.4	97.3
Industry H	1,957.9	1,957.8	1,944.3	100.0	99.3
Industry I	2,641.0	2,625.9	2,568.7	99.4	97.3

For the ViK Karlovac system as a whole, invoiced water consumption drops from 4.64 million m^3 per year in 2006 to 4.54 million m^3 per year in 2008 and 4.29 million m^3 per year in 2010. The drop in 2010 is compounded by the increased number of customers that now receive both water and wastewater network services.

Figure 3 Estimated Water Consumption for Groups of Service User Categories by Core Scenarios



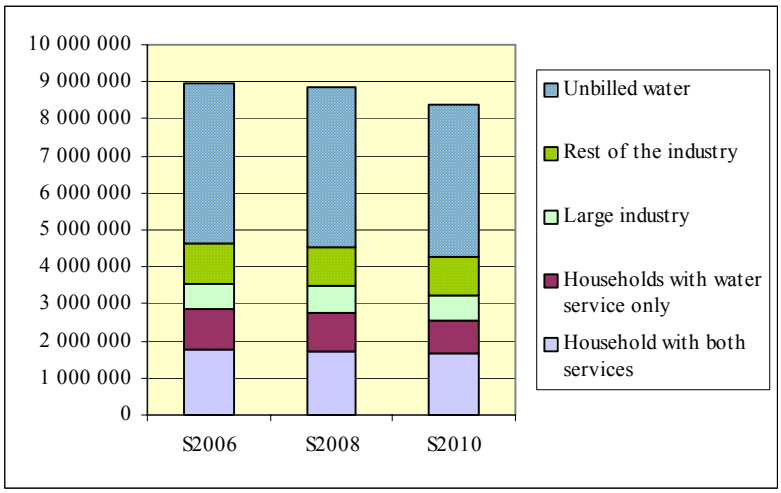
Coincident with the change in consumption is a change in production. Continuing upgrades in the integrity and management of the water network will reduce technical water loss by a few percentage points. Introduction of service agreements will also reduced unbilled water, since certain water consumers (e.g. the Fire Brigade, the city park service, and the waste management company) will have to pay for water consumption, and therefore they will be more cautious about water use – their consumption at present is registered as unbilled water.[18] We estimate that these changes will result in a reduction in "unbilled" water production from 4.30 million m^3 per year in 2006 to 4.09 million m^3 per year in 2010, equivalent to a 5% decrease. This estimate, together with the decrease in water consumption, results in an estimated reduction in total production from

[18] After these entities will be obliged to take water from metered locations, and also to pay for it, not only unbilled water will be reduced, but ViK Karlovac will also receive some additional revenues. The size of these revenues has not been estimated, but according to ViK Karlovac management it is unlikely to be significant, and therefore it is not added to the revenue stream of future scenarios.

2006 to 2010 by 560 thousand m^3 per year. Total production estimates are shown below in Figure 4.

The physical changes estimated here also contribute to the changes in revenues and costs described below. In particular, consumption reductions offset some of the revenue growth due to tariff increases and production reductions offset some of the cost increases due to investment activity.

Figure 4 Estimated Water Production for Core Scenarios

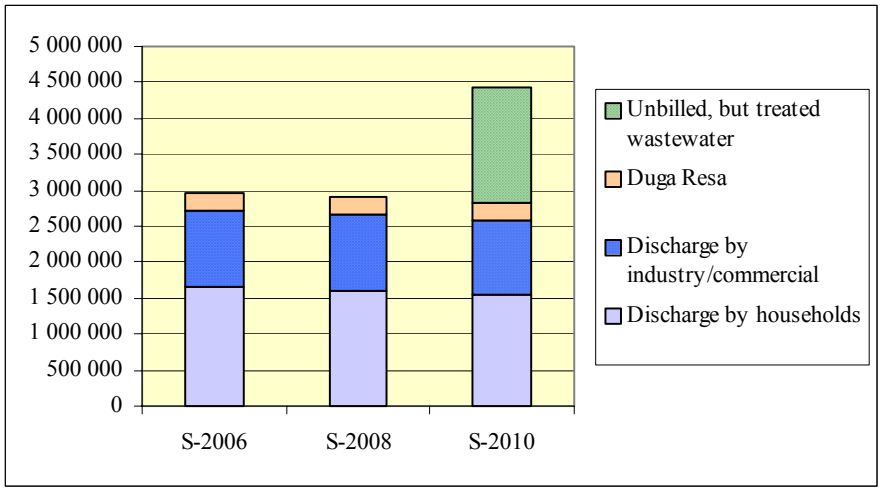


As consumption changes, so does the amount of wastewater discharged, collected and treated under each of the core scenarios. The changes are presented graphically in 0. In the Baseline and the first core scenario, S2008, wastewater is discharged into the sewer system by ViK Karlovac customers but it is not treated beyond some crude screening. Wastewater customers are "billed" for network collection services received from ViK Karlovac but, as noted above, the billed amounts are based on consumption; actual discharges, as estimated in Figure 5, are slight less that the amount billed to most customers. In 2010 actual treatment of wastewater, including infiltration water and storm water, begins.

Between 2006 and 2010 the amount of wastewater estimated to be discharged by customers on the network is estimated to drop by nearly 140 thousand m^3 per year. In addition to customer discharges, ViK Karlovac's sewerage network collects water that infiltrates the network and storm water and, as described elsewhere. The amount of this "unbilled" wastewater that is treated in 2010 is estimated to be roughly 1.592 million m^3 per year[19]. While the infiltration flows might be linked to other values of the water system, we don't have a good basis for estimating the relationship and, perhaps more importantly, we assume that ViK Karlovac will continue to treat the same volume of storm water that flows into the sewer system, even if "dry weather flows" drop with reductions in discharges in 2008 and 2010.

[19] The unbilled, but treated wastewater does not show up in the figure for 2006 since wastewater is not yet treated.

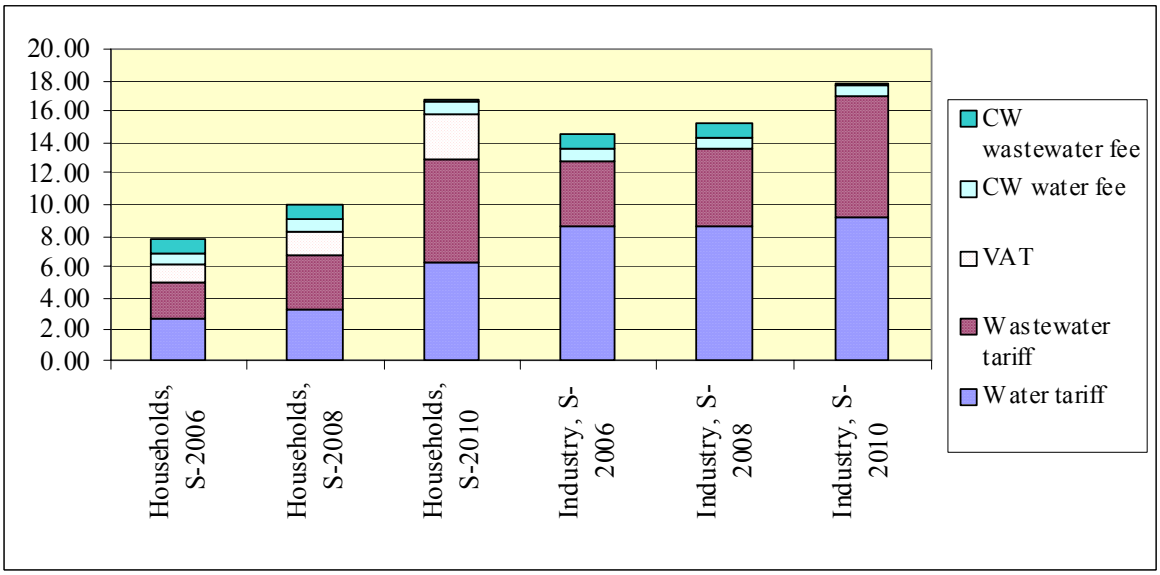
Figure 5 Estimated Wastewater Discharges from Various Sources for Each Core Scenario and Unbilled but Treated Wastewater for 2010



6.1.2. Tariffs

The tariffs of the Baseline are the current tariffs of ViK Karlovac. As shown in Figure 6, tariffs plus taxes and fees substantially increase in 2008 and 2010. The effective tariff faced by households more than doubles and the gap between the tariffs paid by households and industry substantially narrows. Part of the narrowing is due to the role of VAT in the household tariff: as ViK Karlovac tariffs increase, so does the VAT. Under the S2010 scenario, households in 2010 still pay 2.95 HRK/m^3 less for water than industry and 0.95 HRK/m^3 less for wastewater services.

Figure 6 Water and Wastewater Variable Tariffs and Associated Fees for Household and Industrial Customers in the Core Scenarios

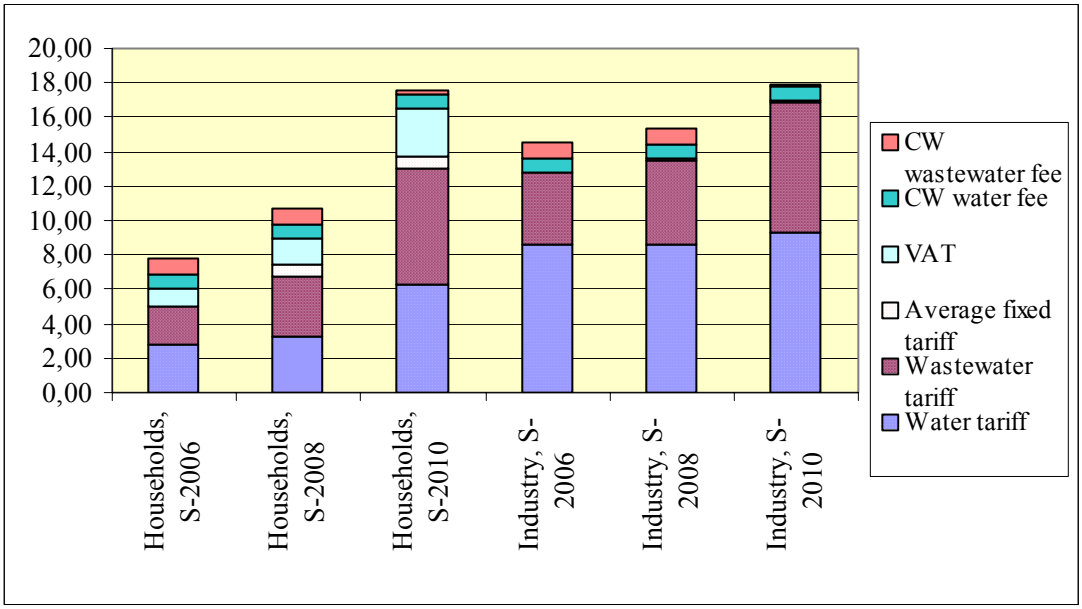


Even so, the tariffs of all three scenarios reflect the principles of tariff reform already adopted by ViK Karlovac. They move toward fully financing the balance of remaining investment costs not covered by grants and they cover all forecast operating costs associated with provision of the upgraded water and wastewater services. Furthermore, they work toward better matching the tariff for a particular service or service user category with the cost of providing that service. The gap between household and industrial tariffs, and the cross subsidy between water and wastewater service, are reduced. Thus the tariffs reflect implementation of several important reform principles encouraged by Morris and Kis (2005) e.g., the tariffs are sufficient to covers explicit and implicit costs in the aggregate (subject to caveats about the CW fees, investment levels, and depreciation) and wedges between tariffs charged and the costs of service for specific services and customers are reduced.

In addition, the tariffs include the introduction of a small fixed monthly charge for water service, as shown in Figure 7. In case of households, the fixed water tariff is equivalent to about 0.66 and 0.71 HRK/m^3 of billed water in 2008 and 2010 respectively[20]. The same figures for industrial users are below 0.1 HRK/m^3 for both years. This way fixed water tariffs further contribute to reduction of the gap between household and industrial tariffs.

While modest in impact – fixed charges only raise about 7.8% of all water revenues in 2008 and 6.1% in 2010 – they introduce a tariff policy principle that, if instituted properly, can further improve the efficiency of tariffs while in most cases also stabilizing the revenue stream. A danger in this course is that the tariff design will become complicated. This may lead to confusion on the part of some customers, causing inefficient decision making, and, abuse of the structure on the part of other customers seeking lower tariffs when their costs or economic status do not merit re-assignment. At this point, however, the design being considered by ViK Karlovac is a relatively simple, two part tariff.

Figure 7 Water and Wastewater Variable and Fixed Tariffs and Associated Fees for Household and Industrial Customers in the Core Scenarios

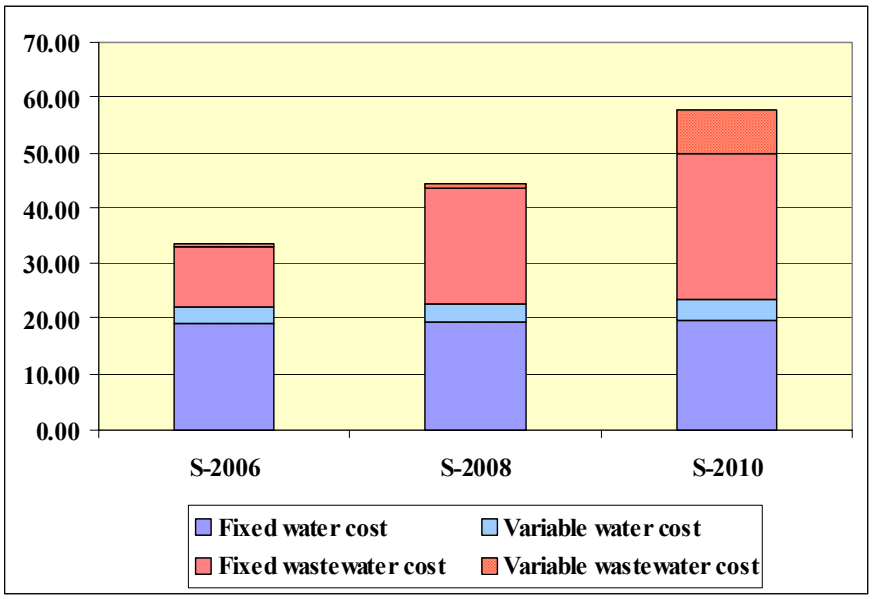


[20] We arrive at this number if we divide total revenues from household fixed water tariffs by the total household consumption.

6.1.3. Costs and Revenues of Core Scenarios

The costs of providing service as the scenarios progress from the baseline through time to 2010 are shown in Figure 8. As shown, the cost of operating the system with the new investment program and background assumptions increases almost HRK 24 million, the vast majority of which is in support of the up-grade in wastewater services in the form of aggressive effluent treatment.

Figure 8 Costs of Service for Core Scenarios by Type of Service and Type of Cost (million HRK/year)



Variable costs are trivial in the short run for the baseline and S2008, but by 2010 variable costs increase substantially due to the cost of operating the WWTP. In this instance, variable costs increase by a factor or almost three for the system as a whole and jump from just over eleven percent of all costs to nearly 20% of costs.

Since the tariffs are, by design, increased to cover costs in S2008 and S2010, the revenues show a corresponding increase. The distribution of revenues by source, however, also reflects tariff and other policy elements that are also part of the scenarios.

Table 17 Revenues for Water and Wastewater Services by Service User Category for Core Scenarios (million HRK)*

	Baseline (S2006)			S2008			S2010		
Service User Categories	Water service	Wastewater service	Total	Water service	Wastewater service	Total	Water service	Wastewater service	Total
Households A, in big apartment buildings	3.753	3.070	6.823	5.255	4.631	9.887	8.704	8.274	16.978
Households B	0.416	0.340	0.756	0.559	0.506	1.064	1.287	1.240	2.527
Households C	0.423	0.346	0.769	0.734	0.514	1.248	1.089	0.889	1.978
Households D	2.862	0.000	2.862	3.904	0.000	3.904	5.965	0.000	5.965
Households E	0.038	0.000	0.038	0.091	0.000	0.091	0.123	0.000	0.123
Industry A, Brewery	4.537	2.182	6.718	4.515	2.561	7.076	4.731	3.896	8.627
Industry B, PPK and Kim	1.449	0.000	1.449	1.450	0.000	1.450	1.543	0.000	1.543
Industry C, former low price	0.227	0.101	0.328	0.231	0.118	0.350	0.242	0.180	0.422
Industry D	0.012	0.000	0.012	0.015	0.000	0.015	0.016	0.000	0.016
Industry E	0.168	0.000	0.168	0.170	0.000	0.170	0.181	0.000	0.181
Industry F	0.106	0.051	0.157	0.133	0.060	0.193	0.138	0.091	0.229
Industry G	0.353	0.170	0.523	0.362	0.200	0.562	0.379	0.304	0.682
Industry H	1.351	0.000	1.351	1.375	0.000	1.375	1.462	0.000	1.462
Industry I	6.451	3.102	9.554	6.502	3.642	10.144	6.810	5.540	12.351
Duga Resa	0.000	0.000	0.000	0.000	0.913	0.913	0.000	1.519	1.519
Total	22.144	9.362	31.506	25.297	13.144	38.441	32.671	21.932	54.604

* Exclusive of grants and transfers.

As these data show, the revenues from households and wastewater service are forecast to provide an increasing share of ViK Karlovac revenues. This is not very surprising given the variable tariffs used in each of the scenarios. The particular revenue values, however, are the product of not only the changes in the variable tariffs, but also, in 2008, of the new fixed tariffs and changes in consumption. In 2010, these influences are further supplemented by changes in the number of customers in some service categories and reductions in "leakage" from the water network.

6.1.4. Customer Expenditures and Burden Estimates

We used core scenarios outputs on consumptions and tariffs to estimate average expenditures for each service user category. These expenditures, including variable and fixed tariffs paid to ViK Karlovac, fees to CW, and, for households, the value added tax, are displayed in Table 18 below.

Table 18 Estimated Average Monthly Expenditure on Water and/or Wastewater (HRK/month/account)

Service User Category	Baseline (S2006)	S2008	S2010
Households A, in big apartment buildings	60	81	128
Households B	72	94	147
Households C	24	35	53
Households D	38	50	75
Households E	6	13	17
Industry A, Brewery	634,320	663,714	791,380
Industry B, PPK and Kim	67,647	67,700	71,621
Industry C, former low price	1,819	1,923	2,275
Industry D	17	22	23
Industry E	447	453	479
Industry F	32	38	45
Industry G	283	301	358
Industry H	1,539	1,564	1,653
Industry I	3,187	3,359	4,000
Duga Resa *	18,750	98,206	150,389

* Under the Baseline the Duga Resa expenditures are limited to the Croatian Waters wastewater fees.

We have also combined the expenditure estimates with estimates of average disposable income for selected household customers to produce crude burden estimates for these customers under each core scenario. These data are presented in Table 19. These data suggest that the financial burden on households of all types for water and wastewater service will more than double from the present to 2010 under the core scenarios.

Table 19 Burden Estimates for Core Scenarios: Average Estimated Expenditures As a Percentage of Estimated Household Disposable Income

Service User Category and Burden Measure	S2006	S2008	S2010
Apt Block Households. Service User Category "Household A". Average expenditure divided by median household net income in 2006.	1.29%	1.74%	2.77%
Individual Houses. Service User Category "Households B". Average expenditure divided by mean household net income in 2006.	1.29%	1.69%	2.63%
Pensioners. Half the consumption of "Household B". Monthly expenditure divided by full pension monthly income in 2006.	1.52%	2.04%	3.25%

Whether these burden numbers are acceptable or not is for water system policy makers, the City of Karlovac, and, just as important, the customers of ViK Karlovac to decide. Economic analysis cannot provide more guidance without a careful examination of customer's valuation of the additional benefits they receive for the changes in service and, even then, the economist's professional opinion is limited to evaluation of the welfare changes associated with efficiency of resource allocation.

Whatever ones assessment of the merit or acceptability of these particular burdens, however, one can agree that, all else equal, less burden is better. One can use ACTEC and Karlovac data to examine how physical and financial conditions, including burdens, might change as we change technical and economic assumptions of the core scenarios. This is what we have done in the following section.

6.2. Sensitivity Analyses

The three core scenarios provide a description of the current status of ViK Karlovac and projections of the physical and financial conditions through the end of the decade. Despite the generous external contributions by ISPA to the ViK Karlovac investment program, the future scenarios indicate that in order to remain financially sustainable ViK Karlovac will need to substantial increase tariffs over and above those just established in 2006. In the following we explore alternative outcomes based on different policies and assumptions.

6.2.1. Possible Cost Savings

The first set of alternative scenarios we ran in ASTEC assumed that ViK Karlovac would take steps to reduce its costs of operation. Each scenario changed one feature of costs in the 2010 core scenario. The cost-saving scenarios examined are described in Table 20.

Table 20 Selected Cost Saving Scenarios Based on Departures from the Core Scenario for 2010

Scenario Name	Description of Cost Savings	Implementation
S10INK	ViK Karlovac revises the terms of its contract with Inkassator	Inkassator fees fixed at 2006 levels
S10CW	ViK Karlovac obtains further fee concessions from Croatian Waters	All Croatian Waters water and wastewater fees are reimbursed to ViK Karlovac
S10LAB	FOPIP identifies opportunities to improve operating efficiency	Direct labour costs and employment taxes are reduced by twenty percent
S10INV	ViK Karlovac adopts a supplementary investment program in line with its recent investment expenditures.	Supplementary investments, i.e. annual investments beyond the ISPA program by ViK Karlovac are 2 million HRK/year, a reduction to 32% of core scenario levels.

The individual results of each of these scenarios are significant but not overly dramatic. In rank order, a reduction in supplementary investment or labor cost savings have the biggest impact on costs and, subsequently, largest potential reduction in tariffs[21]. These potential reductions are over

[21] In each of the examined 2010 sensitivity scenarios we changed the variable water and wastewater tariffs for households as well as industry with the same percentage compared to the core scenario of S2010. This is just one of a large number of sensible combinations of tariffs as a response to changes in operating conditions, but

1.5 HRK/m^3 in combined water and wastewater variable tariffs on the total effective S2010 tariff of 16.82 HRK/m^3 for households and 17.87 HRK/m^3 for industry. The impacts of the other cost reductions are roughly half as effective.

The tariff consequences of the cost saving scenarios are indicated in Figure 8 for households and in 0 for industrial and commercial customers of ViK Karlovac. In case of industrial customers VAT is not added to the tariffs since these entities can reclaim VAT or use it to balance the VAT portion of their revenues.

Figure 9 Household Variable Tariffs Under the 2010 Cost Saving Scenarios (HRK/m^3)

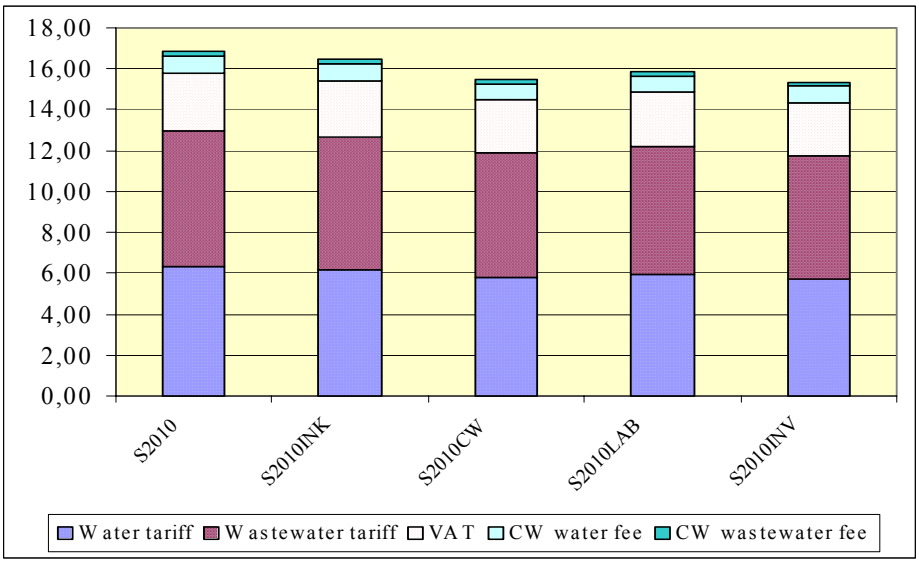
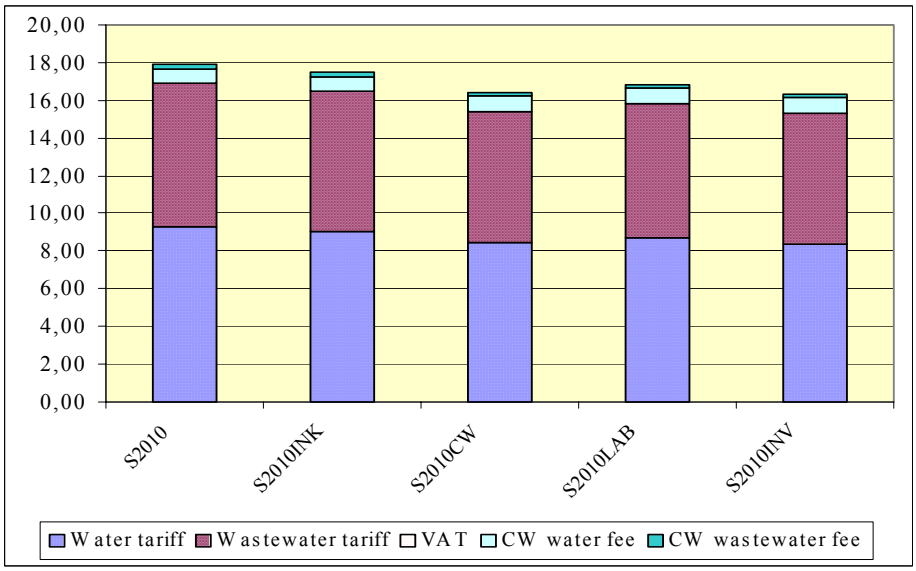


Figure 10 Industrial / Commercial Variable Tariffs Under the 2010 Cost Saving Scenarios (HRK/m^3)



it illustrates well the direction and magnitude of changes as a result of altering some of the 2010 assumptions, and it also stays with the spirit of gradually reducing the gap between household and industrial tariffs.

It is important to note that the size and ranking of these costs savings owes much to the particular values selected for use in these scenarios. The most important inference from these scenarios and their results is that a combination of these four cost-saving measures, effectively implemented, would allow ViK Karlovac to substantially reduce future tariffs while fulfilling the ISPA investment program in an economically sustainable fashion. If all of the assumed cost saving options were fully realized, then the combined water and wastewater tariff for households could be around 12.7 HRK/m^3, or 25% lower than in the S2010 core scenario. The corresponding figure for industrial tariffs is about 13.5 HRK/m^3, again a 25% reduction compared to S2010.

6.2.2. Risk of Adverse Events

We developed two scenarios to illustrate the size and nature of some possible adverse events that could substantially change the technical and financial conditions of ViK Karlovac. These scenarios are summarized in Table 21 below.

Table 21 Selected Adverse Event Scenarios Based on Departures from the Core Scenario for 2010

Scenario Name	Description of Adverse Event	Implementation
S10OC	The operating costs of the WWTP are higher than expected.	WWTP operating costs raised from 3.6 to 4.6 HRK/m^3 of wastewater treated.
S10RT	ViK Karlovac encounters adverse movement in interest rates and exchange rates of the EBRD loan.	A 1% higher interest rate and a 1 HRK/EUR higher exchange rate added to the annual EBRD loan service burden.

Inherent in both of these scenarios is an increase in annual costs, which require an increase of tariffs to keep ViK Karlovac accounts in balance. To re-establish balance, tariffs as in earlier scenarios, are increased by the same percentage for both service and both household and industrial service users. As shown by Figure 11, an increase of the operating costs of the WWTP from 3.6 HRK/m3 to 4.6 HRK/m3 would increase tariffs with about 7.5%, while an adverse shift in the EUR interest rates and the HRK/EUR exchange rate could result in 5% higher tariffs. If both of these adverse events took place simultaneously, the overall increase of tariffs could exceed 12%.

Figure 11 Household Variable Tariffs Under the 2010 Risk Scenarios (HRK/m^3)

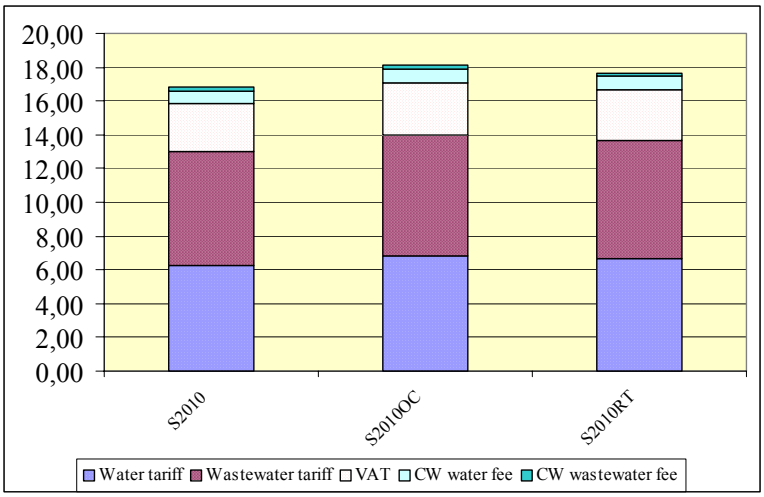
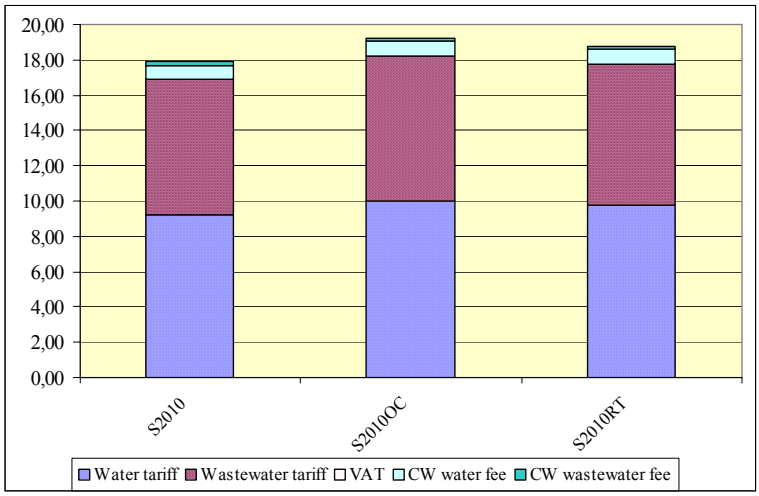


Figure 12 Industrial / Commercial Variable Tariffs Under the 2010 Risk Scenarios (HRK/m^3)



6.2.3. Further Tariff Reforms

These scenarios examine the implications of fully implementing two types of tariff reforms that encourage closer alignment of tariffs with the costs of providing service covered by those tariffs. These scenarios are described in Table 22.

Table 22 Selected Tariff Scenarios Based on Departures from the Core Scenario for 2010

Scenario Name	Description of Tariff Reform	Implementation
S10ET	Eliminate the difference in variable tariffs between household and industry.	ASTEC was run equalizing the tariffs of household and industry but maintaining the cross subsidy from water customers to wastewater customers.
S10CBVT	Cost-recovery tariffs for households and industry in the water and wastewater sectors.	Industry and household have equalized variable tariffs but water and wastewater tariffs are set so as to just recover the costs of each of those services.

In these scenarios there is no change in the level of costs and expenditures[22], but the revenue stream is restructured as a result of the new mix of tariffs. In S10ET variable tariffs are equalized between households and industry. They all pay 7.51 HRK/m^3 for water, and 7.21 HRK/m^3 for wastewater services. At this level, households are paying 1.21 HRK/m^3 more for water, and 0.54 HRK/m^3 more for wastewater service than in S2010. Industry, at the same time, pays 1.74 and 0.41 HRK/m^3 less for these services. These figures illustrate that even after closing some of the gap between household and industrial tariffs between 2006 and 2010, household consumption of water and wastewater services are still substantially cross-subsidized by industrial facilities – assuming that the cost of supplying industry is not much higher than the cost of providing this service to households.

Another type of cross-financing takes place between water and wastewater services – based on the distribution of costs between the two services as applied in the model. Cross-subsidies between the two services are assumed to be small in 2006. After 2006, however, the majority of

[22] Actually there are some relatively small changes in the cost side, as customers react to new tariffs by a change in their consumption, which also has an implication on variable costs. The changes in costs are, however, relatively small, and we will not display them here.

supplementary costs appear within wastewater service – mostly related to amortization of the EBRD loan and operating costs of the WWTP. Even though between 2006 and 2010 wastewater tariffs are increased more than water tariffs in the core scenarios, wastewater revenues still do not keep pace with the large increase of wastewater service costs, and therefore some of the water service revenues are used to cover the costs of wastewater service.

In scenario S2010CBVT we illustrate the case when revenue from each service covers the estimated costs of that service, while continuing to equalize household and industrial variable tariffs. The result is that variable water tariffs are 4.76 HRK/m^3 or 1.54 HRK/m^3 lower for households and 4.49 HRK/m^3 lower for industrial customers than in S2010. Wastewater tariffs on the other hand, at 9.90 HRK/m^3, are 3.23 HRK/m^3 and 2.28 HRK/m^3 higher for households and industry, respectively, than under S2010.

These results are illustrative of how tariffs might shift if ViK Karlovac further presses implementation of more efficient tariffs. Before proceeding with any such policies, however, we would caution ViK Karlovac to revisit the data on cost allocation to customer groups and service categories. The cost allocation rules used in these scenarios are primitive at best and they need to be re-visited and refined before they can be used as a basis for establishing new tariff structures.

Figure 13 Household Variable Tariffs Under the 2010 Tariff Reform Scenarios (HRK/m^3)

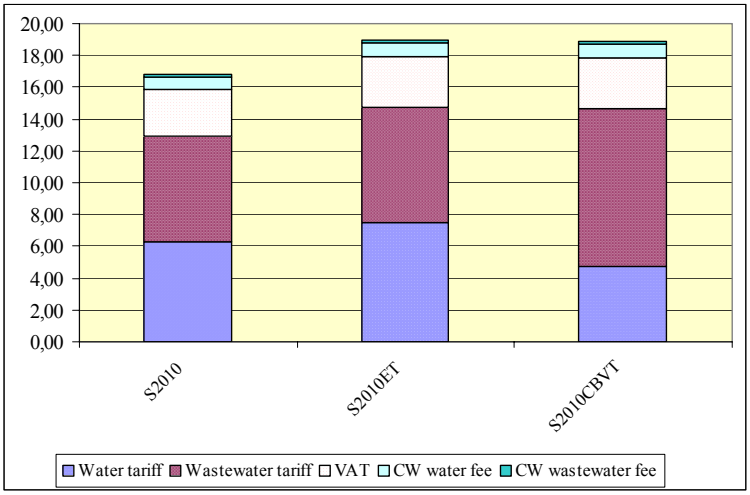
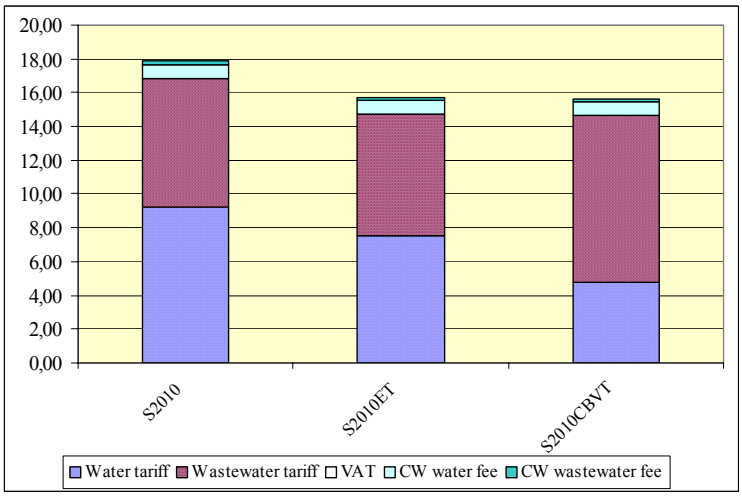


Figure 14 Industrial / Commercial Variable Tariffs Under the 2010 Tariff Reform Scenarios (HRK/m^3)



7. RECOMMENDATIONS BASED ON THE KARLOVAC EXPERIENCE

7.1. Cost Saving Interventions

Cost saving measures are crucial if ViK Karlovac is to restrain future tariff increases associated with the ISPA-inspired investment program. When one factors in the risks of adverse future events, as examined in Section 6.2.2 above, aggressive implementation of a cost saving program is even more justified.

7.1.1. Restructure Collection of Revenues

Inkassator collects water and wastewater service revenues from the households and small businesses of ViK Karlovac. ViK Karlovac reads the meters and passes this information on to Inkassator. Inkassator then issues and mails the bills, collects the revenues, and transfers revenues to ViK Karlovac, after subtracting nine percent as the fee for its services.

We have noted above the data and information problems that have arisen as a result of this arrangement. Inkassator has been unable to provide good quality data, in a timely way, about ViK Karlovac's billing accounts. In particular, extracting individual account or customer class data on billing and payment from the databases of Inkassator seems to be difficult if not impossible. Recently, data from before 2006 has been lost, which further suggests that archiving data is not managed very well within Inkassator. These problems make improved, cost-effective demand planning difficult if not impossible, regardless of whether one is using ASTEC or some other analytical tool.

Furthermore, under current contractual arrangements, ViK Karlovac's payment to Inkassator for billing service increases with the price of water and wastewater. It is clearly not the case, however, that the services have the same cost structure and that such an automatic increase in the payment for billing services is justified. As ViK Karlovac increases tariffs to up-grade networks and improve the quality of wastewater discharge into local water bodies, Inkassator will see its revenues increase without any significant changes in it's costs. An example from the ASTEC core scenarios is instructive. Between 2006 and 2010, anticipated tariff increases would drive up ViK Karlovac payments to Inkassator by over 2 million HRK/year. At the same time one expects little or no increase in the real cost to Inkassator of providing the service.

Moreover, one can argue that the costs of providing billing services have actually declined in real terms over the period since the Inkassator contract was last established and that such costs will likely decline further in the future. The hypothesized real cost reductions are due primarily to widely observed productivity improvements in record keeping and billing software and hardware, and availability of improved direct payment banking services.

Finally, it is has been suggested to us that Inkassator transfers some of the payments to ViK Karlovac with too long a delay, providing Inkassator with cash balances for its use in the interim. We have no real data supporting this allegation but this is one issue that the FOPIP team will likely investigate as it examines opportunities for improving operations and performance.

Given these considerations, we recommend that ViK Karlovac reconsider its contract with Inkassator and issue a new, open Request for Proposal (RFP) for provision of billing and collection services as soon as possible. If not already required by regulations, some conditions should be attached to the RFP that assures several legitimate bids and a transparent selection process. In addition, the Statement of Work for billing and collection services should include provision for systematically and quickly sharing customer account and billing information with ViK Karlovac and transferring balances to ViK Karlovac accounts. We believe this approach offers the best chance for ViK Karlovac to take full advantage of possible improvements of this phase of its operations. Most importantly, the potential cost savings are very important component of any effort to ease the substantial tariff increases forecast by the future scenarios of this report.

7.1.2. Croatian Waters Fees

The service users of ViK Karlovac pay annually more than HRK 5 million to Croatia Waters in the form of water and wastewater fees. If these fees, or the majority of them, landed with ViK Karlovac instead of Croatian Waters, then ViK Karlovac would be in a position to carry out investments without any grants from Croatian Waters or the City of Karlovac. Not only would the financial condition of ViK Karlovac improve substantially, investment decisions would be less dependent on the preferences and priorities of decision makers in the national agencies.

We are not suggesting that development and protection of Croatian water resources have no value. However, we think that water abstraction fees should be based on the marginal cost of water, while wastewater charges should be based on the marginal damages of wastewater effluents. Such fees would still generate revenues, but they would provide the correct incentives for use of the resource, and protection of the natural environment. In the case of Karlovac, there is abundant supply of clean water that is inexpensive to produce. Imposing fees that are well in excess of the costs of protecting this resource does not make economic sense. Likewise, once ViK Karlovac has tertiary treatment, an effluent fee for discharge into the river system should reflect both the good quality of the discharged wastewater and also provide a continuing incentive to the management ViK Karlovac to operate the WWTP to its full potential.

7.1.3. Adoption of FOPIP Recommendations for Improvements in Efficiency

While we have not fully investigated the cost saving opportunities within ViK Karlovac, our view is that there is probably substantial room for improvement in the operating efficiency of the company. The aim of the FOPIP program is to help ViK management identify and utilize these opportunities. We fully support this idea and encourage local decision makers to utilize the recommendations of the FOPIP program. There are several initiatives in particular that we believe may help ViK take better control of its costs:

- Negotiation of a service agreement between the City of Karlovac and ViK Karlovac that spells out what services will be provided to the City and how they are to be paid for under the principle of full cost pricing;
- Introduction of regular performance audits that examine the production efficiency of ViK Karlovac, test this efficiency against peer water system benchmarks, and make recommendation for cost-saving innovations; and
- Introduction of an independent and structured investment management group within ViK Karlovac that will evaluate the costs and benefits of investment programs, helps set investment priorities, and suggest means of financing priority investments the assigns investment costs to investment beneficiaries.

7.1.4. Changes in the Investment Program

In the baseline and core scenarios, it was assumed that ViK would continue investment spending at its "historic" rate e.g., about 1.8 million HRK/year. Given the additional financial impact of the present ISPA-inspired investment program on future ViK investment and operating costs, it might be wise to curtail those elements of the supplementary investment program whose primary purpose is to support expansion of the ViK system. The savings may be used to reduce the amount by which tariffs will have to be raised in order to finance both the ISPA-inspired investment program and other system maintenance investment activities.

The same concern applies to use of funds possibly freed for ViK use should another of our recommendations – that most Croatia Waters fees be retained by ViK Karlovac – be adopted. Transfers from Croatia Waters helped support investment levels that were much larger than 1.8 million HRK/year. While these transfers were substantially less that the Croatia Waters fees collected from ViK customers and sent to Croatia Waters in the first place, the amounts transferred back and earmarked for particular ViK investment projects were still significant. We think it would be a mistake for ViK not to give careful consideration to use of any retained Croatia Waters fees to reduce the tariff pressure resulting from the ISPA-inspired investment program. By the same token, Croatia Waters should be encouraged to continuing the transfer its fee revenues to ViK, but not to limit their use to support of specific investment projects.

Finally, the City's historic investments in expansionary programs should also be re-considered. It is likely that this will happen in any case. The City of Karlovac runs a public assistance program that pays half of the water bill of low income households. Given that sharp increases in water and wastewater tariffs are expected, the cost of such an assistance commitment will greatly increase. This will add to the economic pressure that the City of Karlovac will already feel due to the projected increase in its own water tariffs and those of the public institutions that it supports. It is likely that the City will reduce its support for infrastructure expansion and devote this money to helping those households that are most adversely affected by the tariff increases. Absent City support, the case for ViK Karlovac to narrow expansionary investment projects is even stronger.

7.2. Design and Level of Tariffs

7.2.1. Equalizing Tariffs across Customer Groups

Reducing the gap between household and industrial tariffs is required by the EBRD in its loan agreement with ViK Karlovac. Such a reform makes sense from an economic efficiency perspective as discussed elsewhere. Such a policy may also reduce the financial risk to the lender. By raising household tariffs the revenue stream from households will increase due to the highly inelastic nature of household water demand. At the same time, lower or at the minimum, stagnating, water and wastewater tariffs for industrial customers may increase their competitiveness in output markets and improve the economic prospects of these firms and the local economy of Karlovac in general, all of which will reduce the risk of default.

7.2.2. Introduction of Fixed Tariffs

The majority of the costs of water systems are made up of fixed costs as opposed to operating costs. This is also the case in Karlovac, where in 2006 about 90% of all costs have been estimated to be fixed costs in the short run. Providing service to any single service user is therefore costly,

even if the customer does not consume much water. Some of the consumers of ViK Karlovac consume only a few m^3 of water per month, and some weekend house owners do not consume water during the winter. Under a simple variable tariff scheme, in which only a m^3 tariff is in force, these customers will generate only a little revenue, while the system as a whole must cover its fixed costs. The most straightforward way to increase these customers' contribution to total revenue is through introduction of fixed tariffs.

To test the effect of fixed tariffs on low consumption service users, accounts with less than 5 m^3 of water consumption per month were separated out for two household service user categories in the ASTEC model. 0 below describes the expenditures on water and wastewater services of households so separated.

Fixed water tariffs are introduced in S2008 for the first time. In that scenario, expenditures of low consumption households C and E rise by 48% and 111% respectively, compared to 2006, while for the rest of the households expenditures increase by between 29% and 35%. In absolute terms Households A and B will still pay most for water and wastewater services, but due to the fixed charge the percentage difference compared to Households C and E has decreased. As a result of the fixed charge, the contributions to ViK revenues have become more balanced and less driven by a household customer's share of operating costs.

Figure 15 Monthly Expenditures of Households Under the Core Scenarios

Household Service User Categories	Monthly water consumption in 2006 (m^3/month)	Monthly expenditure (HRK/month/account)			Change in monthly expenditure compared to S2006	
		Baseline (S2006)	S2008	S2010	S2008	S2010
Households A, in big apartment buildings	7.68	59.89	80.53	128.42	34.5%	114.4%
Households B	9.25	72.15	94.40	146.60	30.8%	103.2%
Households C	3.08	24.02	35.50	52.87	47.8%	120.1%
Households D	9.25	38.43	49.54	75.42	28.9%	96.2%
Households E	1.50	6.25	13.17	17.38	110.6%	177.9%

Based on these results, we encourage ViK Karlovac's intention to introduce small fixed water tariffs in 2007 or 2008. While the initial fixed tariff will be very small, considering the huge additional fixed costs involved in the planned wastewater network and WWTP investments future increases would probably be both economically appropriate and financially sound.

7.2.3. Refining Tariff Design Based on Extended Cost Allocation

A capability of ASTEC that we did not exploit in this report is its ability to help design differentiated tariffs based on the cost of providing service to particular customers. The allocation of costs, beyond allocation between the cost of water and wastewater service, was not based on a careful examination of the costs of serving customers with different characteristics e.g. daily or seasonal usage patterns, neighborhood, etc. Examining the impacts of introducing a fixed fee independent of water use was a small example of moving the tariffs system toward a better match of tariffs with the cost of serving customers. In principle, tariffs can be ever more closely tailored to the costs of serving the individual customer.

We encourage further data collection that would support reasonable moves in this direction as part of tariff reform. If such an examination determines that some customers are not paying their

share of costs, then we would further encourage modification of tariffs to reflect these costs. We hasten, however, to add two important caveats to this guidance. First, the costs of initiating, enforcing, and monitoring the new tariff structure – the "transactions costs" - should be relatively low. If transactions costs are high and, in particular, high relative to any expected gains in efficiency, then the proposed tariff modification should be withdrawn. Second, the new tariff structure should still be easy for the customer to understand – no multiple levels of tariffs varying with customer usage – and resistant to attempts to "game" by clever or influential customers e.g., qualify for a preferential tariff on a technicality. As in most things, but especially in pricing such an important service, it is important to take account of the practical limits of implementing otherwise excellent principles.

7.3. Planning for Replacement, Upgrade, and Expansion

7.3.1. Selecting WWTP capacity

ViK Karlovac has some options with respect to the design and capacity of its planned WWTP. There are a variety of ways it might maximize the economic efficiency of these choices and we encourage their consideration. For example, there may be some advantages to ViK Karlovac and some of its larger industrial wastewater customers to negotiate detailed service agreements in anticipation of the WWTP. Larger industrial customers are subject to pre-discharge treatment regulations on industrial wastewater and have some choice regarding the extent to which they will treat wastewater, including the possibility of recycling wastewater for further industrial use. At the same time, much of the effluent they discharge into the sewer may be cost-effectively treated by the second and third stages of the planned WWTP of ViK Karlovac. Pollutants can be either removed by the industrial companies themselves as an extension in the post-usage/pre-discharge treatment process, or they could possibly buy this as a service from ViK Karlovac, while limiting their own treatment activity to screening of solid objects and neutralization of Ph. Such decisions may have important implications for optimal WWTP design and, through a variety of channels, on future costs and revenues of ViK Karlovac. We encourage the water system and its engineering contractors to address the dimension of industrial service demand as part of their consideration of WWTP capacity and design.

Likewise, we also encourage ViK Karlovac and its engineering contractors to carefully consider demand characteristics from other wastewater service users, especially new or potential customers from Duga Resa and neighboring communities, when finalizing design and capacity plans for the WWTP. In general, incorporating some additional flexibility in design to accommodate contingencies related to service quantities and qualities may be worth adopting if the cost of such flexibility is minimal.

7.3.2. Leakage Reduction Is Likely To Be a Poor Investment

In 2006 the amount of unbilled water in ViK Karlovac is about 4.3 million m^3 per year. Most of this amount is leakage; the rest is mostly unbilled consumption and water for technical use. Through proper repair, maintenance and, most importantly, replacement of decrepit sections of the water network, it is possible to reduce leakage. The extent to which ViK Karlovac management will pursue leakage reducing investments may depend on its financial attractiveness. Using ASTEC, we investigated the monetary benefits of leakage reduction. For every 100,000 m^3/year of reduced leakage, annual savings are about 15,000 HRK. This figure is not high, and the reason is that Karlovac is fortunate enough to have an ample supply of good quality, inexpensive water. By

reducing leakage, the company has to produce and pump less water. The cost of producing an additional m^3 of water is negligible, only a little chlorine needs to be added, the unit cost of which is about 0.01 HRK/m^3, but no advanced treatment of the raw water is necessary. Pumping the water within the network, with today's electricity prices, consumes about 0.14 HRK/m^3 worth of energy. Essentially these two cost items, which add up to 0.15 HRK/m^3, is what ViK Karlovac can save if less water needs to be pumped.

Since annual savings from leakage reduction are minor, they justify only lower cost, high reduction investments. 0 below reviews the maximum investment which makes financial sense when leakage is reduced by 100,000 m^3/year. Table 23shows how this value declines with the cost of capital and increases with the duration of the leakage reduction. For instance, if replacement of a network section will reduce leakage by 100,000 m^3/year for a period of 20 years, leakage reduction is the sole purpose of the investment, and the cost of capital is 5%, an investment of up to HRK 196,300 will generate cost savings just equal to the cost of the investment. A larger investment would result in costs greater than the savings.

Table 23 Maximum Investment (HRK) Providing a Positive Return When Reducing Leakage by 100,000 m^3/Year

Annual Cost of Capital	Duration of Leakage Reduction (years)			
	5	10	15	20
0	75 000	150 000	225 000	300 000
5%	68 200	121 600	163 500	196 300
10%	62 500	101 400	125 500	140 700

We have not assessed the current leakage reduction options of ViK Karlovac, but it is unlikely that many of those options would qualify as financially attractive. There may be a few very effective technical measures, however, which would reduce a lot of leakage at a low cost. As ViK Karlovac will be installing flow meters in the water network, it will become possible to identify those network sections where a lot of water is lost, and then related leakage reduction options can be assessed, and should be implemented – if they make sense from an economic and financial perspective.

7.3.3. Development and Use of Data on Economic Depreciation

In the discussion of economic depreciation in Section 9.3 we describe the economic importance of accurate and up-to-date depreciation allowances in assuring the long term, sustainable operations of any enterprise. We encourage ViK Karlovac, as part of its tariff reform efforts, to develop accurate up-to-date depreciation estimates. These depreciation estimates should take account of the economic life of assets and be based estimates of current replacement costs. These estimates should be independent of tax or other legal consideration; they should be planning data rather than financial or reporting data.

This does not mean, however, that other, tax or regulatory estimates of depreciation should not be made. It is not uncommon for firms to keep a variety of accounts, one of which is dedicated to improving firm decision making. It is in this sense that we encourage ViK Karlovac to develop and maintain estimates of "economic depreciation" as part of its management system.

At the same time, we recommend that ViK Karlovac decides in advance and with due consideration how it proposes to share costs among current and future customers. As described in Section 3, the water system is in a position of choosing how to spread the benefits of the current and anticipated financial assistance from ISPA. Establishing a sinking fund to cover current system depreciation may be a way of sharing across generations of users the benefits of "gift" infrastructure like that paid for by an ISPA grant. Absent such a fund, the benefits of the entire gift accrue to current customers and future customers become responsible for the entire cost of replacing the elaborated

infrastructure. There is no correct economic answer to this choice; it is a matter of social preference. At the same time, there are many intermediate positions involving some sharing of the benefits of the gifted infrastructure across current and future customers. We simply encourage ViK Karlovac and the City of Karlovac to make this decision explicitly. Whatever the decision, however, having an estimate of economic depreciation based on replacement costs in hand would aid in establishing the factual basis for making the decision.

7.4. Planning for Adverse Events

As suggested in Section 6.2.2, there are a variety of risks ViK Karlovac confronts that may significantly increase the cost of providing service to its customers. The two risks cited in that Section are the risk of high operating costs for the WWTP and financial risks inherent in the loan agreement with EBRD. There are, additionally, other risks which we have not treated in a scenario e.g., the possibility that water consumption will decline more than estimated with higher tariffs. If both adverse scenarios come to pass, they will increase already high 2010 core scenario tariffs for industry and households by roughly ten to twenty percent respectively. Of course, it may also be the case that these two sources of cost risk move favorably for ViK Karlovac – that operating costs of the WWTP are less than estimated here and that exchange and interest rates decline from current levels.

Whatever the future brings, we believe it would be prudent for ViK to consider planning for risks in several ways.

- First, and most importantly, it could inform its customers and owner about its expectations for future rate increases and emphasize that the future tariff forecasts are highly uncertain due to risks over which ViK Karlovac has some control – such as WWTP operating costs – and those that are fully external – such as the cost of servicing debt.
- Second, it could develop contingency plans to deal with both adverse and advantageous outcomes. These plans could include ways of buffering customers from tariff fluctuations through increase or decrease in funding of the "sinking fund" (if one is created), linking of levels of further external support to the outcome of risky events over which ViK Karlovac has little or no control, and delaying or postponing investment activities, especially expansionary or up-grade investments.
- Third, ViK Karlovac could explore the possibility for hedging future financial risks through re-financing or use of futures markets. Such an initiative requires both substantial financial expertise and is not without its own costs, but ViK Karlovac can certainly find independent financial consultants that would be willing to assist it in this regard.

7.5. Broader Recommendations for Improving the Reform Process

7.5.1. Developing Independent Data and Tools for Advance Assessment

More broadly, we recommend that in the future water systems and water owners such as ViK Karlovac and its owners establish an independent data base and analytical capabilities that allow them to more fully evaluate investment options in advance during pre-feasibility and feasibility assessments. This is especially true for those large scale investments involving grants that are conditioned by financing and performance requirements and requiring substantial increases in

tariffs. Only with this background can all parties discuss in a balanced way the physical and financial implications of the choices involved and arrive at agreements that most efficiently assess both costs and benefits of these options and equitably spread the associated burdens and risks.

7.5.2. Support for Independent Exchange of Information and Experience

In this regard, we feel that substantial advantages can be gained by support and encouragement of a program of national and international cooperation among water system managers and owners. The experience gained by ViK Karlovac managers and City of Karlovac policy makers should not be lost to other water systems and communities. Their experience has made them acutely aware of the importance of independent assessment and advance planning to successfully meeting the interrelated challenges of investment selection and tariff and related reforms. They also have first hand experience of important implementation details that are of immeasurable value to water systems and water system customers that are just beginning to confront these challenges. It would be a great loss if steps are not taken to assure that this experience is effectively preserved and transferred.

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APPENDIX - ELABORATIONS OF VARIOUS ECONOMIC DATA AND PRINCIPLES USED IN THIS REPORT

1 Basic Economic and Price Data for Croatia

1.1 Currency Conversion Factors

A number of currencies, dated with different years, appeared in source documents used in this report. In order to better compare these monetary units, we have converted many of these values into 2005 Kuna. The conversion factors used are based on official Croatian price deflators and currency exchange rates.

Table 24 Currency Conversion Factors from Croatian Kuna (HRK) to Euros (€)

Year	HRK/€ (year HRK/year €)	2005 HRK (2005 HRK/year €)
2000	7.59	8.58
2001	7.37	8.04
2002	7.44	7.98
2003	7.64	8.05
2004	7.67	7.92
2005	7.37	7.37
2006	7.4	7.18

Source: Hrvatska narodna banka-arhiva, www.hnb.hr

1.2 Price Deflators

Table 25 Price Deflators for Converting to 2005 Croatian Kuna

Year	Kuna (Year Kuna/2005 Kuna)	Kuna (2005 Kuna /year Kuna)
2000	0.88	1.131
2001	0.916	1.091
2002	0.932	1.072
2003	0.949	1.054
2004	0.968	1.033
2005	1.000	1.000
2006	1.030	0.97

Note: Consumer Price Index for September 2006 is 112.4

Source: Based on Consumer Price Index. Croatian Bureau of Statistics.

2 Considerations in Estimation of Elasticity of Demand for Danube Region Municipalities

The empirical evidence from most municipalities throughout the world is that the demand for water is highly inelastic: the percentage change in quantity demanded after a price change is much less than the percentage change in the price. Most of this empirical evidence, however, is gathered in settings in which the tariff already covers a large share of the long run costs of providing the services and water expenditures make up a very small part of the household or commercial budget. In most cities in Central and Eastern Europe, the circumstances are different: water tariffs have historically been well below long term costs due to heavy central government subsidies, especially infrastructure subsidies. There is also evidence of substantial cross-financing among service users; while commercial customers may well pay the full cost of service provision, households often pay a substantially lower price. This has certainly been the case in Karlovac.

Another factor is that household income levels are not as high in Karlovac as in most long-time market economies whose municipal water systems have been subject to most empirical research. These lower levels of disposable income may push customers to be more aggressive in their water conservation when price rises. Water demand may not be as inelastic as measured in these high income municipal systems and tariff increases may trigger sharper reductions in demand, especially for households.

Price elasticities of demand, especially for residential customers, also depend on the "starting point". If consumption has been high e.g., more than 200-300 m^3/year for single family residences, then the elasticity actually observed in the neighborhood of this high starting value may be comparatively high. In essence, starting with abnormally high levels of consumption may mean that the scope for water conservations may be relatively large and easy to implement. In Karlovac, however, we observe that average consumption is already relative modest in single family residences with individual meters. This may be the effect of limited incomes but whatever the cause, these starting points do not suggest that these customers have been profligate in their current use of water despite the relatively low price. While apartments in big block buildings without individual metering in Karlovac have a fairly high annual consumption, we applied a low elasticity value of –0.1 because of the lack of individual incentives to reduce consumption.

Since industrial consumers in Karlovac pay a much higher price for their water and wastewater service than households, we suspect that many facilities have already introduced water conservation measures, leaving less room for future reduction of consumption. We uniformly applied –0.1 as the elasticity of commercial entities.

No baseline elasticity estimate has been produced for the Duga Resa Service User Category. While its sewer system has just been connected to that of ViK Karlovac, Duga Resa is not yet being charged for the service.

3 Depreciation and Economic Costs

Public utilities are permitted, under current regulations in Croatia, to use depreciation as an element in the cost basis used to adjust tariffs. Depreciation, as used by economists, is a real resource cost that reflects the loss in the value of an asset with time and use e.g., a piece of equipment used to produce output and, due to wear and tear on the equipment, has a lower market value. As such, depreciation has a solid foundation in economic principles. An enterprise that prices its product without considering depreciation will not be economically sustainable and an

economy that allows its capital and infrastructure to degrade without a plan for its replacement is an economy that is, inevitably, in decline.

Unfortunately, it is often difficult to estimate depreciation precisely and calculations of depreciation can vary widely in practice. Some of this practice also deviates widely from the economic principles that give rise to the concept. In many countries, but especially in economies that have recently transitioned to market systems, depreciation is an accounting item that sometimes has little or no link to the changing value of plant and equipment as they are consumed by time and the process of production. The basis and schedule for depreciation may be arbitrary or seriously in error as these values vary from market-based estimates of replacement costs and economic life.[23] This unreliability is one of the important reasons we chose not to include depreciation as a cost item in the ViK Karlovac accounts developed for ASTEC.

The problem of proper allowance for depreciation in system planning for water systems like ViK Karlovac is further compounded by external "gifts" of infrastructure in the past or grants of infrastructure in the present.[24] However such infrastructure was financed originally, it will eventually have to be replaced in the future. Ultimately, a water system must decide on a policy for financing replacement of a system that is depreciating with time and use by current consumers but that was not paid for by current consumers, as would be the case for infrastructure financed fully by internal resources.

As described in a draft DABLAS (2006) report, "good practice requires that the water system, its owners, and its customers have a clear vision of how they will finance the full costs of current service levels." In this case, ViK Karlovac needs to decide how it will finance replacement of gifted infrastructure: by borrowing (debt) in the future or saving (local sinking fund) in the present. Debt financing requires that future customers pay principal and interest on new debt used to fund replacement infrastructure. Creation and use of a local sinking fund requires that current customers use the financial "breathing space" provided by the gifted infrastructure to pay into reserves that will finance all or part of the infrastructure when it needs to be replaced. Which approach is best depends on conditions in domestic and international capital markets, expectations regarding future incomes and prices, and, to a considerable extent, the perspective one adopts regarding what is "fair" to present and future customers. Not to make this decision explicitly is to adopt, by default, a policy of future borrowing financed by future system customers.

4 Burden Estimation

A common metric that is thought to be of help in evaluating the merit of a water tariff proposal tariffs is one that measures, in one way or another, the budget share required to purchase the good. This is frequently referred to as an "affordability" measure. Unfortunately "affordability" is a term of art that strikes us as at best misleading - since anything is affordable up to the limits of disposable income (and sometimes beyond) if the consumer values it enough – and at worst a willful mis-representation of economic theory – since it suggests that any good that one can afford

[23] Accounting or calculated "depreciation" may be accepted as a cost by regulatory or tax authorities or the procedures used may meet "domestic" or "international" accounting standards, but, unfortunately, this doesn't guarantee that that the calculations are economically sound.

[24] We put "gifts" in quotes here because past bequests of water system infrastructure from the central government are not free in a broader sense. These bequests were financed by resources collected from throughout the state and, while in any particular instance the local community may have received more that it contributed to the project, over all projects the community may or may not be a net beneficiary.

is worth purchasing. We prefer the term "burden" when discussing such a metric, since its aim to measure the burden that consumption of a good places upon potential consumers.

Burden indices are usually computed as a percentage ratio of expenditures on the service to some measure of budget or disposable income. The numerator should include all elements of the cost of the service that will reduce the amount of money available for other purchases. In the case of ViK Karlovac, this means that the price used to compute expenditures should include not only the ViK Karlovac tariff but the CW fees and, for households, the VAT on water and wastewater services.

Choosing a denominator is a little trickier. In principle, one wants a denominator that reflects the disposable income of an average customer in any service user category. Disposable income measures are most commonly computed intermittently e.g., with every census of population, and for large aggregates e.g., on a national basis. Computing disposable income measures for a given service user category, in a given locality, in a given year, usually requires application of approximation and estimation methods since direct data are not ordinarily available. In our burden estimates, we used related data e.g., median salary data rather than median disposable income, to scale and adjust past disposable income data for households in Karlovac and to construct estimates of disposable income for several service user categories.

Despite our best efforts, these burden estimates must be regarded with skepticism. At a minimum, we are characterizing a typical condition in world in which many customers – households and businesses alike – are atypical. Both consumption and financial circumstances can vary considerably within a service user category. The burdens actually imposed will range from trivial to abusive. At best, burden estimation provides decision makers with a better sense of how burdensome their investment and tariff decisions are likely to be to typical water system customers, not whether the decisions made are good or bad and certainly not whether the decisions are economically defensible.

The real question to answer – the one an economist would be most comfortable with - is whether the decision will produce incremental value or benefits commensurate with the incremental tariff or cost customers and others are being asked to pay. Answering this question is an important part of properly evaluating the economic merit of an investment program and that program's financing. Tariff and effluent charge reforms may support the program by providing more efficient financing as a result of cost savings or more efficient allocation of costs. The reforms may also support an economic evaluation by providing a better basis for judging the merit of the investment program. Our work here focuses on the former advantages of these reforms. A broader evaluation, including an evaluation of the service and environmental benefits of an investment program was beyond the immediate objectives of our work on tariff reforms. Calculation of burden indices provides a deficient surrogate for such evaluation. In the absence of better measures, however, they can be useful so long as the decision maker is aware of, and understands, their limitations.

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