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MODERNISING MUNICIPAL INFRASTRUCTURE IN CENTRAL AND EASTERN EUROPE IN THE CONTEXT OF EU ENVIRONMENTAL POLICY

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Foreword

Cities in Europe are increasingly challenged by their responsibilities to provide public services and infrastructure. Many of them face the necessity for the modernisation and restructuring of their public infrastructural facilities, e.g. the local public transport infrastructure, utilities, waste disposal and others. Progressively adverse demographic developments require new solutions and additional action to be taken. For the New EU Member States also the European Union (EU) legislation implementing high quality standards is an important driver in modernising municipal infrastructure. A wide range of technological answers to the different needs and necessities in the municipal infrastructure can be attested. But while the need for renewal and maintenance is growing, the conventional basis for financing public infrastructural facilities - taxes and fees – is often shrinking. As a result, many municipalities modernising their infrastructure have to deal not only with technological issues and challenges but also with the question of how to finance it. While the big cities have for the most part managed to extend their public services through international development programmes or by public-private partnership, small and medium-sized municipalities often lag behind.

In this situation it is important to look for alternative financial and organisational models. Possible solutions may include cooperation models between a group of communities and/or between communities and private partners. Also selling off its municipal operating companies can offer a regional administrative body the opportunity of reducing budgetary deficits, but de facto only in large cities can an investor expect cost-effective backflows. Thus, municipalities have to verify meticulously which course of action a municipal company should take when pressing ahead with restructuring.

It is evident that in the particular field of municipal public services interaction between the local government, municipal administration, and the concerned population will play a prominent role. A suitable political and institutional framework is the basis for an effective and efficient provision of technical and social infrastructure to the population. Administrative officials often will need continuing learning to make the right decisions for their particular case.

To rely on the experiences of other municipalities may help to overcome existing reluctance to strike a new path and it also may impede precarious decisions. External organisations, institutions, and companies acting in the field can help to find optimal solutions, for instance by developing financial concepts based on the funding of national or European institutions, by making applications and implementing support, by mediation between the various interest groups and players, by selecting the economic format if privatisation or part-privatisation is provided, by finding investors, by drawing up the required contracts, and by ensuring overall economic efficiency for the local authority.

Reflecting this situation, the Leipzig University's Zentrum für Internationale Wirtschaftsbeziehungen and the Fraunhofer Zentrum Mittel- und Osteuropa decided to organise a seminar

on *Modernising Municipal Infrastructure in Central and Eastern Europe* to bring together experts in municipal finance, public service managers and respective administrators, technological experts and providers of the necessary technologies and know-how with the objective to share the latest state of the art, to discuss experiences, and to promote best practices and solutions for modernising municipal infrastructure in Central and Eastern Europe. From the wide range of municipal services we chose two: *Water and Wastewater* and *Waste Disposal*. However, for the most part the financial and organisational models will be applicable to other public services, too, so that communes and suppliers can make good use of the outcomes. The regional focus being on the New EU Member States, we were lucky to include as an excursus the paper by a Russian conference member on the situation and the challenges in modernising municipal infrastructure in the Russian Federation.

The organisers conceive the conference outcomes and the network of experts who convened at Leipzig as a first attempt to both constant study in the field of public services in Central and Eastern European countries and assistance of CEE communities improving public services and reducing environmental pollution by modernising their infrastructure. In pursuing this aim ZIW and MOEZ benefit from the support of the university's Competence Centre of Public Economics and Public Finance and its interdisciplinary team of experts in law, environmental technology, sustainability, energy management, public finance, and public services.

Special thanks go to all contributors of this volume as well as the Deutsche Bundesstiftung Umwelt (DBU) and the Gelsenwasser AG whose grants made this conference possible.

Cornelie Kunze / Thomas Lenk

1 INTRODUCTION

Thomas Lenk, Tatsiana Makarevich, Oliver Rottmann

Financing the Modernisation of Municipal Infrastructure under Fiscal Constraints

1. The Challenges of Municipal Infrastructure in Germany and Europe

Public utilities and public services have been one of the most important responsibilities of local authorities since the introduction of municipalities. However, during the 19th century, the public services sector in Europe has widened substantially. The emerging industries and the growing urban population forced local authorities to take over responsibilities in the fields of gas, electricity and water supply, sewage, waste disposal, and public transportation. Typical for this set of activities – called "Daseinsvorsorge" in Germany – has been the view that local authorities should act in the interests of the common good of the local community. Despite these commonalities, the definition and the history of public services differ from country to country. While in most EU Member States such services are largely provided by local or national governments, in the UK the private provision is more significant. Implying that "public services" can be delivered both by public servants and by a private company, the European Commission introduced the term "services of general interest."

During the lasts decades, globalisation processes as well as economic transformations in Central and Eastern Europe brought about changes in the industrial structure and the economic performance of regions and caused a growing regional differentiation all over Europe. Economically dynamic regions enjoy demographic surplus, whereas economically weak regions show demographic loss. Regions with declining populations coexist with those experiencing population growths in almost all European countries. At the same time, the EU legislation continues to develop a framework of standards which aims to harmonise technological and organisational solutions and environmental regulations among the Member States. Regardless of whether growing or shrinking, most Central and Eastern European communities inherited municipal service structures which hardly ever meet European standards.

There is no doubt about the urgent need for investment in public infrastructures in this region. However, the investment requires a closer look at the ongoing processes of economic restructuring, demographic development, and resource-saving practices. East Germany's transition history offers an illustrative example. East Germany sustained a dramatic deindustrialisation following reunification. In the early 1990s, water infrastructure was modernised and extended due to substantial funding programmes to meet West German and EU service standards as well as the anticipated growth in demand following the economic recovery. However, the actual level of water consumption has fallen dramatically. Today it is 40% lower than in 1990. The high level of state subsidies for investments will burden state budgets for decades to come (Moss 2008). Furthermore, the underutilisation of technical

infrastructure networks raises problems of functionality. In the affected areas, the issue is generally about how to meet the demand for basic services. Since most of these systems have high fixed costs and significant sunk costs, downscaling the technical networks is a long-term task. Decline in consumption does not lead to a corresponding decrease in infrastructure maintenance cost; this phenomenon is known as the "cost remanence effect" (Lenk and Rottmann 2006: 18). Therefore a number of local and regional governments are searching for new technical and organisational forms of public infrastructure under shrinking conditions.

For many different reasons it has become increasingly common for governments to observe ever stricter fiscal constraints both on the national and local level. Not only in shrinking regions but even in growing areas is the financial power of the communities quite limited. The aim of this paper is to discuss how a fulfilment of local governments' task can be ensured in the future. One of the possibilities is the involvement of private companies in public service delivery. There is a growing share of services of general interest offered by private enterprises or those in mixed ownership in nearly all European countries. However, after a period of growing openness towards privatisation, local authorities, researchers, and the public opinion now even consider remunicipalisation. Furthermore, small and economically weak municipalities will probably face difficulties in attracting private investors to modernise their public infrastructure. Therefore another way, especially for the municipalities in Central and Eastern Europe, will be the application for European or other funds (Lenk et al. 2010). Another strategic choice that local governments have at their disposal is cooperation with other municipalities. In the following we discuss private sector involvement as well as inter-municipal cooperation in the provision of public goods and services including the modernisation of the respective infrastructure as a way to share the financial burden and improve sustainability of service delivery.

2. Theoretical Implications of Public (Economic) Activities in a Market Economy

The key question is why governments offer goods and services in market economies at all, although economic theory tells us that a free market system is able to coordinate economic decisions better than the planned economic system of state-supplied services. Despite the elegance and simplicity of the market theory, its adoption in practice is restricted. The real-world markets bear little resemblance to a perfectly competitive model. Furthermore, if the market does not deliver an outcome acceptable to the community, governments can legitimately intervene in the functioning of markets in order to improve the level of economic efficiency (Munday 2000). We can say that any partial or complete state-controlled service delivery is justified whenever the conditions for an efficient market solution cannot be met, i.e. under circumstances of "market failure." In the majority of cases, the reasons for market failure are:

- imperfect competition (monopolistic structures),
- external effects,
- public goods (non-exclusivity and non-rivalry in consumption),
- incomplete and asymmetrical information of market participants, and
- extremely high transaction costs of private actions.

The government's (or the local government's) responsibility is to counter microeconomic inefficiency by means of corrective measures. Especially with regard to goods that require a network structure and have a higher tendency to develop monopolistic structures due to technical reasons, the state frequently favoured public supply in the past. However, since state intervention must rely on incomplete information for its action, governments as well as markets may fail. EU Commission policy is currently heading towards the adoption of the enabling state paradigm which emphasizes a market-oriented approach. One goal of this approach is introducing competition between private as well as between public undertakings. Public enterprises are subjected to increasing scrutiny because of the EU-competition strategy directed at the transformation of national markets into a market of at least European-wide dimension.

In the following we discuss two of the possible responses to the challenges faced by municipalities. The first one is to involve the private sector in the provision of services of general interests. Another way to cope with these issues is inter-municipal cooperation.

3. Privatisation of Public Services

There are only two fundamental objectives given for privatisation. The first one is the enhancement of economic efficiency and effectiveness in service delivery. The expectation is that private suppliers must produce and sell at the lowest possible prices because of competitive pressure. This approach is accepted in economic theory but it seems to fall short of reality. Existing markets are mostly less competitive in comparison to ideal markets, and so the goal-oriented initial intention of privatisation frequently leads to unexpected and unintended results in the real world. "Private markets do not naturally serve the public interest – they require good governance and regulation in order for the market's games to be played according to fair and effective rules for all" (Hodge 2007: 2).

Another reason for demanding privatisation efforts is the tight financial situation of public budgets. Thus, the second fundamental objective is to raise revenue for the budget. Selling state assets is a legitimate way of reducing government debt. The cost-saving effect may be achieved, on the one hand, by terminating the subsidies of unprofitable public enterprises and, on the other hand, by positive revenue generated by the privatisation of profitable public enterprises.

In general, privatisation represents a dynamic concept, which generally involves the transfer of public services or public assets to the private sector. The possibility of privatising may not exist for different tasks to the same extent.

Privatisation is perceived as having many chances and risks. The chances attributed to the objective to privatise public companies have to be investigated on both the macro-level and the micro-level (Lenk and Rottmann 2008: 22). The macro-level includes objectives such as increasing public revenue, enhancing allocative efficiency, reducing state influence, and stimulating competition. The micro-level describes, for example, intended enhanced efficiency

within an enterprise, which might result in lower prices, a higher quality level, and increased profitability.

However, in addition to the chances there are also risks. With regard to privatisation it can principally be assumed that the commitment of any private investor is intended to generate profit. This might cause conflicts as the objective of the municipality is to provide services as efficiently as possible. Further asymmetric interests become evident when considering different types of private partners, which might be either a strategic investor or a financial investor. A strategic investor usually strives for a strategic expansion of the enterprise portfolio; such an investor is interested in a long-term strategic commitment. Financial investors, on the other hand, often strive for a short-term repayment of interest for invested capital (yield), which could be contradictory to the sustainable character of public management (Lenk and Rottmann 2007: 16).

A complete privatisation might entail some risks because the privatised enterprise gains a quasi-monopoly position. This can imply disadvantages for the consumers and the municipality as well. Also, the guaranteeing obligation and the task to regulate private public companies rest with communal authorities. So in practice, the municipality has to secure a vital water supply even if the supplier is unable to deliver, such as in case of insolvency or permanent defective performance or non-performance.

The target conflict is established, on the one hand, by the fact that municipalities must exert effective supervision of supplying private companies and, on the other hand, must maintain inefficient parallel structures, so as to be able to step in as a supplier whenever this shall be required. Other possible negative consequences for the public are job losses or jobs offered at lower wages.

There is nothing uniquely inherent in the act of a privatisation that assures an increase in competition, especially not when a public monopoly is substituted by a private monopoly as discussed above. It requires the removal of barriers to competition, i.e. diminishing factors that impede competition and to reduce supply monopolies (Aune, Golombek et al. 2008).

Beginning from an initial situation of state provision, four ideal types of privatisation can be distinguished by considering the extent of the transfer of the property right towards private control.

In case of material privatisation, a certain good or service that was once provided by the government is rendered by the private sector, and the government completely withdraws from a given task by selling its assets. This case is also called “true privatisation.” For example, through the sale of a municipal water supply company to a private firm, the public task of water provision is fully transferred to the private sector. The economical risk as well as the decision-making is thereby completely submitted to the purchaser. However, in general, there is no responsibility transfer for ensuring service provision linked to a material privatisation. Since the municipality still has the obligation to guarantee the adequate provision of public

services, it must also ensure that the private supplier is controlled. This can be achieved for instance through supervisory boards.

A single modern municipality can barely manage to carry out public tasks on its own without relying on some (public or private) partner organisation. Given that a certain goods and services provision is divided into sequences or includes easily-specified support tasks, the government can perform its obligation by placing an order to the private companies. Here, functional privatisation (contracting-out) is taking place and implies that not a complete task is privatised but rather only an associated activity. The central idea behind contracting-out is to reduce the scope of state activity and to promote and maintain competition (Dudley and Bogaevskaya 2006: 36). The right of ownership and responsibility of public authorities remain unaffected. Thus, an enterprise providing public transport may assign certain parts of the rendered services to a private company, such as the task to run school buses in rural areas. Government guarantees of responsibility can be met by choosing a business operator by bid and thereby secure its influence by means of control rights.

As for the financed privatisation, because of the tight financial situation of German public budgets and growing common public sector borrowing, financing models are increasingly used as a means to fulfil public tasks. In most cases decision-makers rely on special financing models offered by credit institutions. Examples of such financed privatisations are capital market oriented funding models that are implemented in order to carry out the financing of communal construction projects.

Finally, formal privatisation implies only a change from a public to a private legal structure. Thus, the services are indeed performed by a private company. However, this company is run under public authority or at least subjected to its control. The legal structure of a private enterprise implies the possibility of remaining unbound by budgetary law, so the enterprise can profit from enhanced flexibility and economic viability in the execution of its task. This type of privatisation is quite common in energy supply. In this case the task of energy supply remains with the previous administrator; only the operating agency is transformed into a business form under private law. The shares of these newly-established enterprises are held either completely or in majority by the municipality.

4. Inter-Municipal Cooperation

Another approach, which is gaining importance in the ongoing debate about remunicipalisation, is the cooperation of municipal bodies. Inter-municipal cooperation has a long history in many countries and is highly respected because it seeks to combine two values deeply embedded in certain government systems: local self-government and rational governance (Hulst and Montfort 2007: 8). On the one hand, inter-municipal cooperation allows local government to maintain local control over policies. On the other hand, it rebalances or adapts the territorial organisation in geographical or economic terms.

Similar to concentration processes in the private sector, the set-up of bigger units plays a key role in cooperation projects. It is a way to increase the capacity for solving policy problems and overcoming limitations of small local governments (Hulst and Montfort 2007: 11). Joint provision of goods and services can correspond with cost cuts, effective and efficient performance (Stopper 2008: 210), and strengthened competitiveness of municipal bodies. The introduction of inter-municipal cooperation is further motivated by the decreasing economic performance of individual municipalities caused by demographic developments and the risk of service interruption.

Eventually the reasons to enter the partnership vary. The regionalisation of financial support on a European and national level make use of incentive requirements to stimulate inter-municipal cooperation. Technical development in the infrastructural sectors made some undertakings no more optimal since the size of a local population is simply too small, and the risk of cost remanence is evident. Bigger infrastructures with over-/far-reaching significance require finding a location for a region. Complementarity and mutual functional complementation is in the foreground for suburban areas. Cities rely on their surrounding area: for supply (e.g. drinking water), for disposal (e.g. waste, sewage), local recreation, and as an ecological balancing area. Suburban regions are considerably dependent on the core-city with regard to central infrastructural offers (Hollbach-Grömig et al. 2005: 13-14).

Cooperation as well as any other organisational and strategic change entails chances and risks. Joint provision of public services could benefit from synergy effects and create economies of scale. Cooperation is seen as a tool to enhance allocative efficiency and to secure the nation-wide stability of service supply. They play a particular role in regions with declining populations. For instance, through high fix costs in water and energy supply networks, the capacity adjustment on decreasing demand is more difficult than on increasing demand. Inter-municipal cooperation is a possibility to reduce or eliminate cost remanence. In a partnership for cooperation municipalities could also benefit through transferring or sharing the risks with a partner. This could further increase the credit-worthiness and thus lead to better access to the capital market. Cooperation increases bargaining power with suppliers and with other levels of the national or European administration.

Along with the benefits, inter-municipal cooperation is exposed to risks. Cooperation programmes, in some cases, mean a loss of autonomy and of control over resources. This issue is particularly relevant when there is a high degree of dependence on the cooperation partner. Transaction costs (especially personnel and time costs) induced by inter-municipal cooperation, as well as by cooperation with private partner, are not to be underestimated. Moreover, changes in the decision-making process lead to changes in democratic control and influence.

German legislation provides a variety of legal forms for cooperation projects. According to the extent of the transfer of ownership rights and responsibilities, inter-municipal cooperation falls into three categories: delegated cooperation, service agreement, and joint agreement.

Delegated cooperation is a written arrangement where one municipality (a "lead" donor) acts with authority on behalf of one or more other local governments (the "delegating" donors or "silent partners"). In this case, the responsibility for service provision is transferred by changing the territorial jurisdiction. The "silent partners" are exempt from the provision of certain service. All rights and obligations are passed over to the "lead" donor that is fully authorised in relation to third parties and therefore responsible for fulfilling the task. The "lead" donor then accepts economic risk and takes over the decision-making process. This type of cooperation lends itself to partners that differ in economical potential, such as a city and its suburban areas.

A service agreement exists when one local government accepts a contract to provide a service to another local government for an agreed upon charge. The responsibility for the task's completion remains untouched. The local government is still responsible for securing service provisions. For instance the water utility of Town A provides services for Town B for a certain charge. Town B ensures adequate water supply to all citizens.

A joint agreement can involve either the creation of a public corporation, which will be responsible for the task's completion, or it can set up local working groups where the members coordinate activities without abandoning their responsibility. This form of cooperation is among the most well-known forms and has a long tradition in Germany. The local authorities share the provision of specific public services through establishments that are responsible for this undertaking. It is often used in water supply and sewage disposal. A city and suburban regions that are working together to operate a sewage treatment plant is an example of a joint agreement, wherein participating local governments share in the provision of a service.

5. Summary and Conclusion

The intention of EU policy to shift from the "active state" to the "enabling state" challenges local governments. Aware of their fiscal constraints, municipalities seek to ensure continuity of adequate provision of public services. One strategy is to privatise the services. However, it is important to remember that in addition to the advantages – efficiency increasing, cost reduction, and stimulating competition – there are also disadvantages: decline of public control and the danger of substituting a public monopoly with a private monopoly. Once the services have been privatised, municipalities might consider remunicipalisation, but the question is whether they can actually afford to do so financially. Another strategy is to cooperate with neighbouring municipalities which means to share functions, infrastructure and amenities, and at the same time refining their profiles in accordance with their neighbours. Because each situation is unique, each strategy should be reviewed on a case-by-case basis. At the end of the day, the decision will be political and should be taken upon consideration of all risks involved and the implications of different choices.

References

Aune, F. R., Golombek, R., Kittelsen, S. A. C., Rosendahl, K. E. (2008), Liberalizing European Energy Markets. An Economic Analysis, Cheltenham.

Dudley, L., Bogaevskaya, A. (2006), Contracting as Policy: Worldwide Implications, in: Hodge, Graeme A. (ed.), Privatization and Market Development. Global Movements in Public Policy Ideas, Cheltenham (Monash studies in global movements), pp. 36-62.

Hodge, G. A. (ed.) (2006), Privatization and market development. Global movements in public policy ideas, Cheltenham (Monash studies in global movements).

Hollbach-Grömig, B., Floeting, H., Kodolitsch, P. von, Sander, R., Siener, M. (2005), Formen der interkommunalen Zusammenarbeit im Rahmen der kommunalen Wirtschafts- und Infrastrukturpolitik. Endbericht für das Bundesamt für Bauwesen und Raumordnung BBR, herausgegeben von Deutsches Institut für Urbanistik (Difu), Berlin.

Hulst, R., van Montfort, A. (2007), Inter-Municipal Cooperation: A Widespread Phenomenon, in: Hulst, R., Montfort, A. van (ed.), Inter-Municipal Cooperation in Europe, Dordrecht, pp. 1-23.

Lenk, T., Makarevich, T., Rottmann, O. (2010), Challenging Budgetary Situations – Municipal Management, in: Chobanov, G., Plöhn, J., Schellhaass, H. (ed.), Policies of Economic and Social Development in Europe, Frankfurt am Main and others, pp. 139-159.

Lenk, T., Rottmann, O. (2007), Öffentliche Unternehmen vor dem Hintergrund der Interdependenz von Daseinsvorsorge und Wettbewerb am Beispiel einer Teilveräußerung der Stadtwerke Leipzig, University of Leipzig, Institut für Finanzen (Working paper No. 36).

Lenk, T., Rottmann, O. (2008), Grundlegende transaktionskostenökonomische Analyse öffentlicher vs. privater Leistungserstellung, in: Wirtschaftswissenschaftliches Studium (WiSt), Vol. 37, No. 1, pp. 21-26.

Lenk, T., Rottmann, O. (2006), Die Wirkungen des Gleichmäßigkeitsgrundsatzes II zwischen kreisfreiem und kreisangehörigem Raum im sächsischen kommunalen Finanzausgleich: University of Leipzig, Institut für Finanzen (Working paper No. 38).

Moss, T. (2008), 'Cold Spots' of Urban Infrastructure: 'Shrinking' Processes in Eastern Germany and the Modern Infrastructural Ideal, in: International Journal of Urban and Regional Research, Vol. 32, No. 2, pp. 436-451.

Munday, S. C. R. (2000), Markets and Market Failure, Oxford (Studies in economics and business).

Stopper, J. (2008), Kooperation zwischen Gemeinden als Handlungsstrategie, in: Sackmann, R., Jonda, B., Reinhold, M. (ed.), Demographie als Herausforderung für den öffentlichen Sektor. Wiesbaden, pp. 207-226.

2 MODERNISING INFRASTRUCTURE IN THE FIELD OF WASTE DISPOSAL

Stanisław Karuga, Lidia Sieja

A Strategy for Municipal and Industrial Waste Management in the Silesian Voivodeship

1. Municipal Waste

1.1 Strategy for Municipal Waste Management in Poland

The strategy of actions for establishing modern municipal waste management in Poland is stipulated in the country's National Waste Management Plan. As a main line of action, the National Waste Management Plan 2010 (NWMP) indicates intense increases in the use of both biological (composting, fermentation) and thermal methods of converting waste. Moreover, waste management facilities should have sufficient capacity to process waste from areas inhabited by at least 150,000 residents or urban and municipal units serving more than 300,000 residents, where the preferred method is thermal conversion. The NWMP does not define specific locations for new installations. It indicates that the voivodeship's plans refer to specific regions (groups of municipalities) in which common municipal waste management will be executed and regional facilities will operate. In the 2008-2013 period, the NWMP stipulates that the municipalities groups have to create regional systems for municipal waste management.

In European Union countries, where technologically advanced waste management systems operate, proven organisational arrangements involve the cooperation of municipalities in the municipality groups. In Poland, municipality groups are known that also operate successfully for several years. However, the still dominant and even preferred solution by municipalities is the individual arrangement. Such an approach cannot be considered forward looking.

Modern waste management in accordance with European standards is largely the maximum of waste recovery and neutralisation with methods other than disposal. Therefore, one of the main objectives identified in the NWMP is the progressive reduction of landfill waste disposal, particularly of biodegradable waste. It should be noted that at least half of the mixed municipal waste is biodegradable waste.

The EU Directive 1993/31/WE and the Polish Waste Act specify the levels of reduction of biodegradable waste that must be achieved starting from 2010. In the EU Accession Treaty, Poland has committed itself to reducing the amount of biodegradable waste going to landfills in 2010 to 75%, in 2013 to 50% and in 2020 to 35% of the amount of biodegradable waste generated in 1995.

To be able to meet the accession obligations (and to avoid penalties) it is necessary to substantially increase waste treatment, which means ensuring adequate capacity and the

installation of biological and thermal waste transformation. The NWMP also points to other main objectives to be achieved:

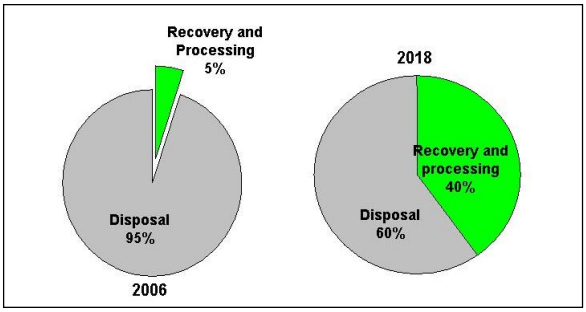
- development of separate waste collection, particularly the potential secondary raw materials and packaging waste,
- increasing levels of recovery of the following waste types:
  - bulky (including consumer electronics),
  - dangerous,
  - construction and repair,
- ordering landfills state, and
- increasing the level of ecological awareness of citizens.

The construction of the envisioned modern and complex waste management system should be based on the following basic assumptions:

- Biological processing of waste (composting, fermentation) is conducted solely on the basis of organic waste because it is only possible in this case to obtain compost which will meet the legal requirements. In the case of a process based on mixed waste, the product obtained is suitable only for disposal, and after the Decree of the Minister of the Economy on the eligibility criteria for waste disposition, which comes into effect in 2013, the material may not meet the conditions for entering the landfill.
- Separately collected waste is directed to a sorting facility, where further treatment of the material takes place before it is passed to secondary raw materials processing parties.
- Installations for mechanical and biological processing operate as facilities allowing the reduction of waste going to a landfill (up to 20%); the remains of the throughput go to disposal. It should be taken into account that after 2012 (in accordance with the Regulation of the Minister of the Economy dated 7 September 2005 on the criteria and procedures for approval of waste disposal [Dz.U. of 2005 No. 186 item. 1553, as amended]) waste after mechanical and biological throughput cannot be put to disposal.
- In large cities and urban areas an integral part of municipal waste management system is the installation of thermal waste processing.

The strategy of actions in municipal waste management is shown in Figure 1.

Figure 1. Municipal waste management strategy according to the National Environmental Policy

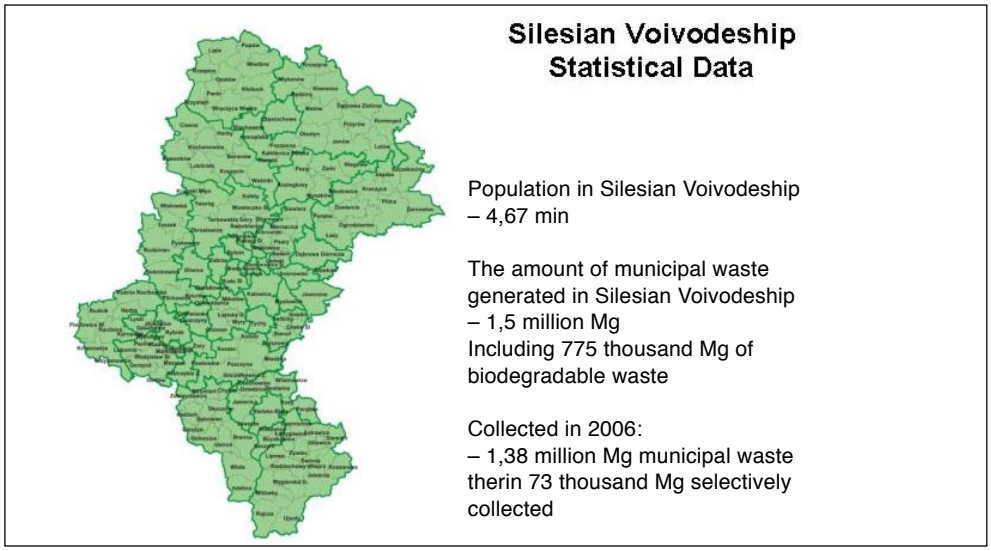


Source: National Waste Management Plan 2010 (NWMP).

1.2 Activities in the Municipal Waste Management arising from the Waste Management Plan for the Silesian Voivodeship

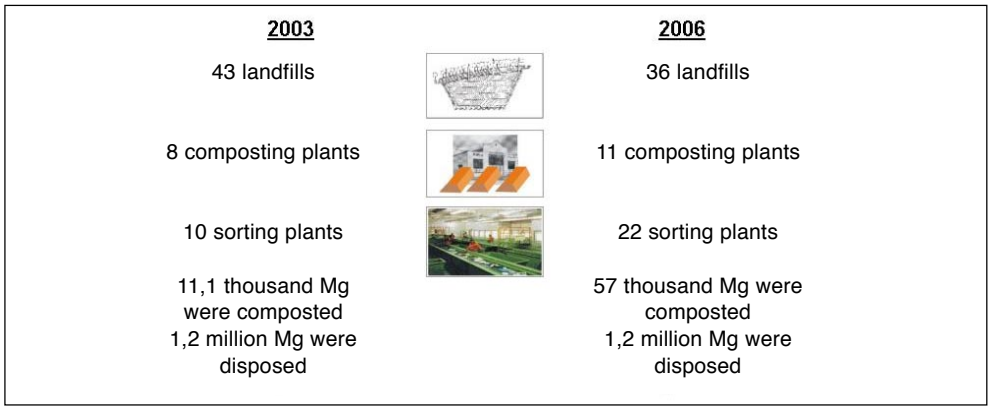
While Figure 2 shows statistical data for the Silesian (Polish: Śląskie) voivodeship, Figure 3 illustrates the condition of facilities for recovery and neutralisation of municipal waste in the voivodeship.

Figure 2. The Silesian Voivodeship: Statistical data about municipal waste in 2006



Mg: (Polish) cubicmeter.
Source: Waste Management Plan for the Silesian Voivodeship.

Figure 3. Condition of facilities for recovery and neutralisation of municipal waste in the Silesian voivodeship (number of facilities)



Source: Waste Management Plan for the Silesian Voivodeship.

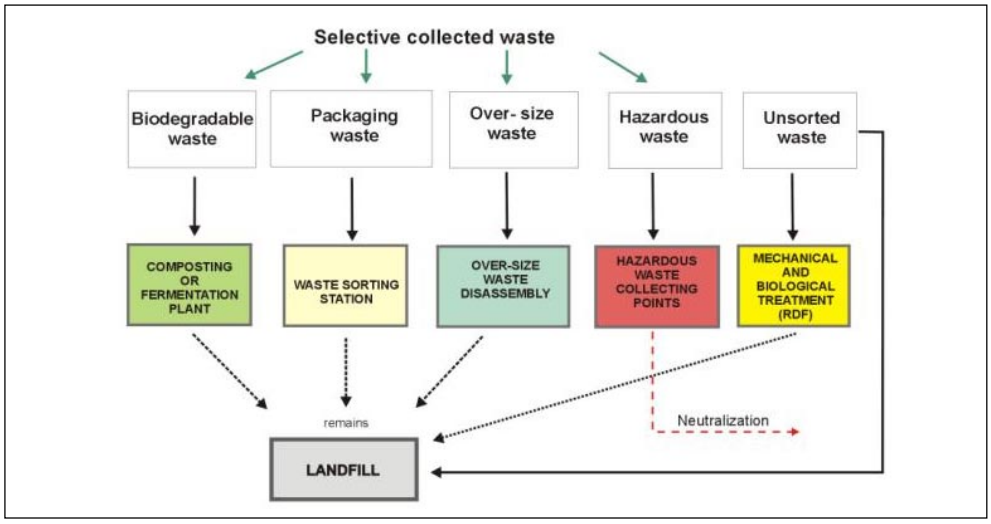
The municipal waste management plan for the Silesian voivodeship assumes the principal, following objectives:

- that the entire population of the voivodeship signs municipal waste collection agreements,
- ensuring that all residents of the voivodeship have the possibility of selective collection of waste,
- reduction of disposal of biodegradable municipal waste to 75% in 2010 and 50% in 2013 compared to the quantity of waste generated in 1995,
- reduction of the municipal waste amount disposal to 86% compared to the amount of waste generated,
- obtaining significant results in selective collection of the following waste:
  - hazardous in the municipal waste stream,
  - bulky products including household appliances and electronic equipment,
  - useful for recycling including the packaging waste entering the municipal waste stream, and
  - renovation and construction waste of the municipal waste stream.

The condition for the progress in implementing advanced solutions for municipal waste management is regionalisation. The waste management plan proposes that the voivodeship ultimately creates 11 regions (municipality groups), which will operate regional facilities of joint municipal waste management. Within each of these 11 regions a modern regional system will be created or upgraded. It is recommended to create two model solutions for municipal waste management (cf. Fig. 4 and 5):

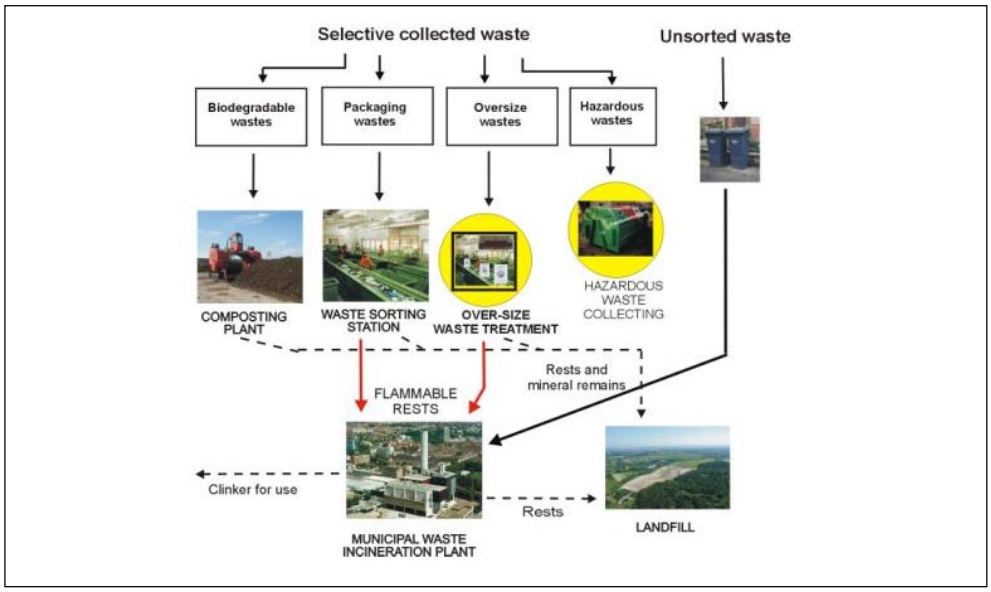
- Model A – including mechanical and biological treatment of waste,
- Model B – including thermal transformation of waste.

Figure 4. Model A: Municipal waste management including mechanical and biological treatment of waste



Source: Waste Management Plan for the Silesian Voivodeship.

Figure 5. Model B: Municipal waste management including thermal transformation of waste



Source: Waste Management Plan for the Silesian Voivodeship.

1.3 Thermal Waste Conversion: An Essential Component of the Municipal Waste Management in the Silesian Voivodeship

The voivodeship waste management plan stipulates the construction of two thermal waste processing facilities, which "will be taking" approximately 30% of generated municipal waste of the voivodeship in the future.

One of the 11 proposed regions is Upper Silesian Metropolitan Union (USMU), a region where the construction of a modern, complex system of municipal waste management is particularly important. This area covers 14 cities with county rights and accounts for 15% of the voivodeship area with 2 million inhabitants or 44% of the total number of inhabitants of the voivodeship. This region produces around 760,000 m^3 of municipal waste annually or 50% of the waste generated in the entire voivodeship. 14 municipal authorities reached an agreement on accession to the implementation of the joint municipal waste management system.

Figure 6. Map of Metropolitan Association of Upper Silesia GZM

Source: Górnośląski Związek Metropolitalny.

In a region with such a high level of urbanisation, the use of thermal processing in municipal waste management system is indispensable. The concept developed for USMU therefore assumes that the incinerator facility will be an essential element of a complex solution. According to the concept developed for the USMU, a part of the waste will be directed to mechanical and biological treatment, while the main waste stream will be directed to two waste incineration installations (each with 250,000 m^3 of waste per year). The construction of thermal processing facilities is planned for the period from 2012 to 2015, and the project for the construction of these facilities will be co-financed by the Operational Programme "Infrastructure and Environment." The cost of implementation is estimated at 256 million EUR of which 141 mil. EUR is expected as a grant.

2. Waste from the Economic Sector

2.1 Quantities of Waste Generated from the Economic Sector

In 2006, the Silesian voivodeship produced a total of 43.4 million m^3 of waste in the economic sector (excluding municipal waste), of which 0.8% were hazardous waste. The largest amount of non-hazardous waste has been generated as a result of production activities in the following groups:

01	Waste generated in the survey, extraction, physical, and chemical treatment of ores and other minerals	75.1%
10	Wastes from thermal processes	16.0%
19	Wastes from the plants and facilities for waste management, waste water treatment plants and drinking water treatment and water for industrial purposes	3.6%

By contrast, the largest quantities of hazardous waste were generated as a result of production activities in the following groups:

11	Wastes from chemical treatment and coating of metals and other materials and non-ferrous hydrometallurgical processes	38.4%
10	Wastes from thermal processes	17.8%
19	Wastes from the plants and facilities for waste management, waste water treatment plants and drinking water treatment and water for industrial purposes	17.1%
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics	10.0%

2.2 Estimated Quantities of Waste from the Economic Sector

From 2003 to 2006, the amount of waste generated in the economic sector in the Silesian voivodeship increased by about 10%, i.e. 38,947.9 thousand m^3 of waste were generated in 2003 and 43,297.2 thousand m^3 of waste in 2006. There has been a marked increase in the quantity of hazardous waste generated in 2004 (by 38% compared to 2003) and 2005 (by 30% compared to 2004). In 2006, the quantity of hazardous waste rose by only 6% compared to 2005. However, these data do not fully reflect the facts. This is due to, inter alia, a lack of information about the waste produced in small and medium-sized enterprises.

Having regard to the above presented data on the quantity of waste generated from the economic sector within the Silesian voivodeship, it is expected that in the years 2008-2018 the increase in the volume of waste generated will stabilise and reach the level of 3% per annum for non-hazardous waste and 0.5% for hazardous waste.

The change in the quantity of waste from the economic sector in the years 2008-2018 will be influenced by:
- the overall economic development in the Silesian voivodeship,
- the upturn in global steel products and steel,
- the development of the building industry and thus the production of building materials and supplies for finishing and furnishing,
- the emergence of new installations for recovery and disposal of waste,
- changes in technologies of production, leading to minimisation of waste quantity,

- intensified inspections and inventory of the waste,
- changes in technologies of production, leading to management of specific types of waste in production processes in plants, and
- the bankruptcy of manufacturing companies or change in direction of activities.

Table 1. Estimated amounts of non-hazardous waste and hazardous waste in the 2008-2018 period

Year	Estimated amount of waste [thousand m^3]		
	non-hazardous	hazardous	total
2008	45,624.6	357.4	**45,982.0**
2010	48,403.1	360.9	**48,764.0**
2012	51,350.8	364.6	**51,715.4**
2014	54,478.1	368.2	**54,846.4**
2016	57,795.8	371.9	**58,167.8**
2018	61,315.6	375.6	**61,691.2**

Source: Województwo Śląskie, Główny Urząd Statystyczny w Katowicach.

It is anticipated that in 2018 the amount of waste generated in the economic sector in the Silesian voivodeship will amount to more than 61 mil. m^3 of waste of which 0.6% will be hazardous waste.

2.3 Installations for the Recovery and Neutralisation of Waste from the Economic Sector

There are 476 installations for recovery and neutralisation of non-hazardous waste, 63 plants for recovery and neutralisation of hazardous waste, and 5 installations for thermal processing of medical and veterinary waste in the Silesian voivodeship. Some of these facilities provide services in recovery and neutralisation of both non-hazardous and hazardous waste.

Waste from the economic sector is also neutralised through storage at 39 active landfills:
- for non-hazardous and inert waste (17),
- for hazardous waste (10),
- for inert waste (2),
- where waste containing asbestos is deposited (4), and
- mining landfills (6).

Analysis of the capacity of recovery and neutralisation of non-hazardous and hazardous waste from the economic sector and the free capacity of landfills operating in the Silesian Voivodeship showed that there will be no need for neither building new facilities, constructing new landfills nor expansion of existing facilities and landfills in the years 2008-2018.

Business surveys revealed that businesses meet the environmental protection requirements and that the need for the closure of installations for recovery and neutralisation of waste

from the economic sector will not occur until 2018. By contrast, on the basis of information from the conducted surveys of landfills, it was found that there is no need to close landfills for non-hazardous and inert wastes, landfills for hazardous waste, landfills for inert waste and landfills where waste containing asbestos is deposited.

2.4 The Objectives of Waste Management in the Economic Sector

The established goals until the year 2018 are listed in the following. For non-hazardous waste, the goals are:

- minimising the quantity of waste other than hazardous and inert,
- progressively increasing the participation of non-hazardous waste and inert subjected to the processes of recovery and disposal operations other than disposal,
- preventing or reducing the waste amount and its negative impact on the environment,
- work consistently with the principles of environmental waste recovery if it failed to prevent their generation, and
- adhere to the principles of environmental waste neutralisation, where the generation could not be prevented and which could not be recovered.

The goals for hazardous waste which is subject to special management rules include:

- increasing efficiency of the system for hazardous waste collection from diffused sources, mainly from small and medium-sized enterprises,
- minimisation of the amount of hazardous waste generated,
- progressive increase of the amount of hazardous waste subjected to the processes of recovery and neutralisation,
- ecological education of producers of hazardous waste on the dangers of uncontrolled flows of hazardous waste into the environment, and
- development and increase in efficiency of collection and neutralisation of equipment containing CFCs, and prevention of release of these substances into the air.

3. Summary

As a result of economic activity, significant quantities of wastes are generated in the Silesian voivodeship. The largest quantities come from mining, energy, and metallurgy. The Silesian voivodeship occupies the first place in the whole country in terms of the quantity of waste being generated and waste being managed.

The positive effect of measures taken by the industry in recent years is the systematic increase in the amount of waste destined for recovery. From 2003 to 2006, waste recovery has increased by 13% and the level of 45.8 mil. m^3 was reached. During that time, waste neutralisation has also risen by 46% to 1 mil. m^3. This is advantageous for the environment because it reduces its waste load and thus improves the condition of water, air, and soil around the disposal facilities.

Changes observed in the generation, recovery, and neutralisation of waste generated in the economic sector were caused by:

- the ongoing process of restructuring heavy industry (mining, metallurgy, and energy),
- the implementation of the requirements of best available techniques in production processes and the implementation of low and non-waste technologies, and
- the need to meet the legal requirements for the level of recovery, recycling, and neutralisation of certain types of waste.

The last decades in the Silesian voivodeship have been dominated by high waste technologies, and the main way of dealing with waste has been deposition in heaps, in post-mining excavations, landfills, waste water disposal sites, and distribution in the areas distorted by industrial activity.

The execution of the tasks set out in the Waste Management Plan for the Silesian voivodeship will be beneficial to the environment, particularly in the areas of:

- reduction of landfill waste disposal, thereby reducing their impact on water, air, and soil,
- reduction of environmental degradation in relation to the proposed closure and remediation of some municipal and industrial landfills,
- progressive elimination of disposal of biodegradable waste with the most negative consequences for the environment, including the production of landfill gases that impact the greenhouse effect,
- gradual elimination of the introduction of hazardous waste whose disposal poses a threat to the health and life of humans and animals, and
- the landscape condition in the areas of municipal and industrial waste landfills.

The objectives stipulated in the plan are in line with EU directives, the national environmental policy, and the National Waste Management Plan 2010. Prevention and minimisation of the amount of waste generated can be effective when using broad educational campaigns. The implementation of low and non-waste technologies will have a significant impact on the reduction of waste generation in the industry.

References

Aktualizacja krajowego Planu Gospodarki Odpadami, uchwała Nr. 232 Rady Ministrów z dnia 29 XII 2006r. (M.P. z 2006 r. Nr. 90, poz.. 946).

Aktualizacja Plany Gospodarki Odpadami dla Województwa Śląskiego, Uchwała Nr. III/37/3/2009 Sejmiku Województwa Śląskiego z dnia 29 kwietnia 2009 roku.

Zoltán Pápai

Modernising Waste Management in Hungary: The Miskolc Regional Waste Management Project

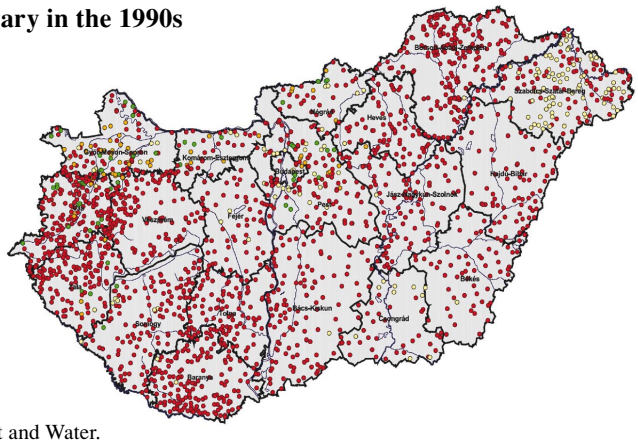
1. General Information on Solid Waste Management in Hungary

As in most other Central and Eastern European countries, the waste management system in Hungary was far from meeting European standards in the beginning of the 1990s. Thus, during the EU accession process, an adaption to the requirements of the acquis communautaire had to be achieved or had to be started at least. In November 2002, the National Environmental Programme (NEP) was adopted by the Hungarian parliament, and one part of the NEP was the National Waste Management Plan. The main aims of this plan are the following:

- until 2005 – renovation or closing down of incinerators,
- until 2008 – 50% of the waste will be reused or recycled,
- until 2009 – recultivation or renovation of the old landfills,
- from 2009 on – no difference between the waste management in Hungary and in the EU.

According to the National Waste Management Plan, the Regional Environmental Inspectorates have to prepare waste management plans for the seven statistical planning regions, which were published by ministerial order of the Minister of the Environment and Water. Correspondingly, the municipalities have to prepare local waste management plans. Companies with significant influence in waste management (more than 10 tons of hazardous waste or 200 tons of waste per year) are obliged to prepare individual waste management plans and consult with the local municipalities. The Regional Environmental Inspectorate has to assent these individual plans. All waste management plans are designed for six years, and after two years they must be revised. Thus, the waste management system helps to coordinate the national, regional, local, and individual level.

Figure 1. Landfills in Hungary in the 1990s



Source: Ministry of the Environment and Water.

According to the plans, the modernisation of the Hungarian waste management sector advanced quickly. As early as in 2002, 1,300 old landfills of overall 2,667 had been closed. Another 1,151 old landfills were to be closed by the end of 2005. 216 landfills were granted by permission until 2009. Only 42 landfills were planned to get the permit after 2009.

The current plans for the period from 2005 to 2020 suggest:
- the modernisation of 42 existing landfills,
- the construction of 10 new landfills,
- the construction of 13 transfer stations,
- 22 new/enlarged landfills (realised through the ISPA programme 2000-2002), and
- 20 new/enlarged transfer stations (realised through the ISPA programme 2000-2001).

As a result of these innovations, 74 landfills and 33 transfer stations will be accomplished at the end of the planning period.

Landfills which were designed with geotechnical liner and leachate collection system can be licensed as B1b type landfills. These landfills can receive waste containing low amounts of biologically degradable components. In practice, this waste is usually construction or demolition waste and the bottom ash waste from incinerators.

Figure 2. Planned waste management network in Hungary for 2020

Source: National Waste Management Plan of Hungary.

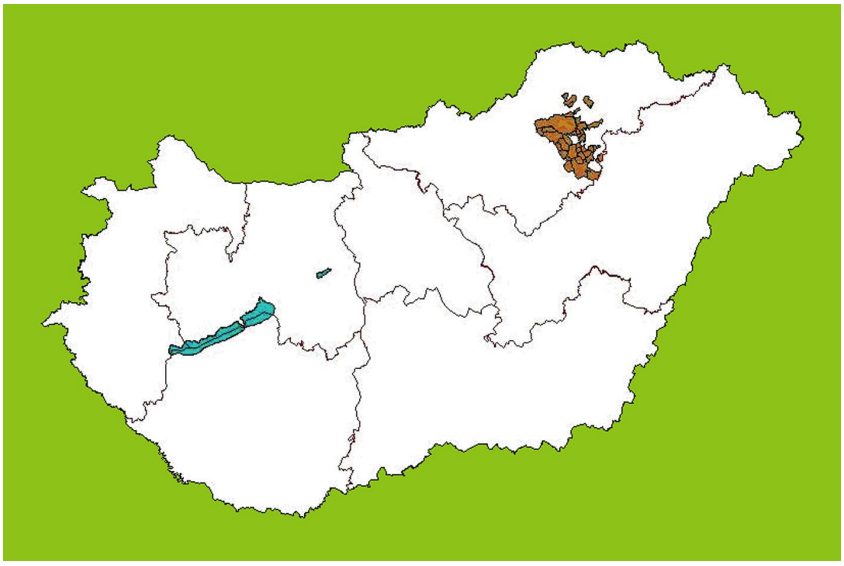
Most investments in the solid waste management sector will be made with the EU's ISPA programme. To illustrate this process, the Miskolc Regional Waste Management Project (2000/HU/16/P/PE/004) will be presented in the following.

2. Contents and Technical Parameters of the Miskolc Regional Waste Management Project

The city of Miskolc is situated in the Borsod-Abaúj-Zemplén County in North Hungary. The project is an example for both the cooperation between a number of municipalities for modernising their public infrastructure and the use of EU programmes in that process. Furthermore it is an example of an effective private-public partnership for the company AVE Miskolc Ltd. is a public-private partnership of the Municipiality of Miskolc and AVE Magyarország Ltd. The AVE Magyarország Ltd. waste management company is an affiliate of the Austrian infrastructure group Energie AG Oberösterreich and operates as a holding company of nine further associated companies in Hungary. AVE Magyarország Ltd. is hundred per cent owned by Energie AG Oberösterreich. It is the leading public service company in the waste management sector of Hungary. AVE Magyarország has a share of 55% in AVE Miskolc Ltd.

Originally the project involved 38 municipalities of the region but was implemented with 37 (ca. 267,000 inhabitants) because Mályi (4,500 inhabitants) left the consortium after the approval of the tender documentation and joined the Sajó-Bódva Valley Waste Management Partnership. The waste management system is owned by a consortium (partnership without legal personality) comprised of the municipalities. The Miskolc Regional Waste Management Project did not only aim to upgrade the technical infrastructure but also to minimise the amount of dumped waste by means of pre-treatment and recovery and by raising the inhabitants' awareness of the minimisation and separate collection of waste.

Figure 3. Geographical location of the Miskolc Regional Waste Management Project



Source: Municipality of Miskolc.

The main elements of the technical upgrading were the following:
- the construction of a central waste treatment facility in Hejőpapi,
- the edification of three waste yards in Lórántffy Street, József Attila Street, and Bogáncs Street in Miskolc and the construction of a waste sorting plant and transfer station in József Attila Street,
- the closure and reclamation of the Miskolc-Nádasrét central landfill in Miskolc-Bogáncs Street and further 18 unsuitable or illegal dumps, and
- the purchase of the equipment necessary for the operation of the system.

The first element was the construction of a highly efficient central waste treatment facility in Hejőpapi for the whole region. Hejőpapi is about 30 km away from Miskolc. In this new facility, which covers a surface of 25.7 ha, the following activities are performed in accordance with EU requirements:
- composting organic waste in a composting plant with a capacity of 8,000 tons,
- final sorting of selectively collected materials and preparation for recycling in a baling and sorting plant with a capacity of 15,000 tpa (tons/year). (The sorting plant was established in Miskolc, in József Attila Street where selectively collected waste is sorted with the help of a sorting line and is then machine-baled. The complex sorting and baling hall in József Attila Street has a nominal capacity of 15,000 tpa. At the landfill the selectively collected waste transported from the surrounding towns is sorted manually and baled by a machine, i.e. no sorting line was installed at the landfill.),
- operating a transfer station for municipal waste – 100,000 tpa licensed capacity, and
- disposal of the non-recoverable, remaining, non-hazardous communal waste.

All communal waste generated in the 37 towns involved in the project is now dumped at Hejőpapi. Construction/demolition waste collected from households is normally not deposited at the landfill. Actually, it is deposited at the landfill in a small quantity only (exclusively for building a causeway and to ensure the movement of vehicles transporting the waste at the dump yard) after it is pre-treated with the waste shredder-sorter equipment. So far all construction and demolition waste generated in Miskolc and its surroundings was dumped at the Bogáncs Street landfill together with the region's communal waste. As this landfill was closed and reclaimed during the project and the Hejőpapi landfill site is established now, the possibility to jointly dump construction and demolition waste and communal waste has ceased. Since no statutory requirement exists for municipalities to provide a possibility for disposing of construction/demolition waste generated in their territory, the solution of this problem was not included within the objectives of the project. Otherwise, there is a possibility to dispose of the remaining construction/demolition waste because there is an operating reusing facility in the Miskolc area that holds a permit for the disposal, dumping, and treatment of this waste type.

The new landfill site with an area of approximately 10 ha is fully insulated. The maximum available dump volume is approximately 2,000,000 m^3 (compressed). This magnitude ensures the disposal of solid communal waste over a period of at least twenty years. The remaining waste will be disposed with the "hill elevation" technology. The geotechnical liner of the

landfill consists of geological and artificial liners (3 x 20 cm clay with k = 1 x 10-9 m/s + 2 layers of HDPE 2,0 mm thick geomembrane + mechanical and blockage protection by geotextile with a density of 1,200 g/m^2) which fully meet both European and Hungarian guidelines. The landfill has a drainage system (30 cm 16/32 gravel with pre-filtering geotextile with a density of 250 g/m^2) that collects the leachate and is led into the leachate water pool. In the summer months the leachate water is sprinkled back from the pool to the landfill from where it evaporates. The leachate can be transferred by a sewage pipe to the nearby sewage treating facility in Mezőcsát where final treatment of the leachate can be carried out.

During the decomposition of the organic part of the waste dumped at the site, biogas can release from the surface of the landfill. In order to prevent any possible negative air emission, a biogas collection system has been installed (49 biogas wells, biogas collection pipes, 2 main collection pipes, adjusting stations, condensation pits, torch, controls station).

Figure 4. Dumping ground Hejőpapi (initial phase)

Source: AVE Miskolc Ltd.

The area of the Hejőpapi Regional Waste Treating Facility can be accessed from two directions: Hejőpapi (access road I – length: 1,402 m) and Emőd (access road II – length constructed under this project: 2,140 m). The actual length of access road II is 2,861 m, however, only 2,140 m were built under this project as the other 721 m were built in connection with the M30 motorway project.

Figure 5. Hejőpapi Regional Waste Treating Facility: Weigh-bridge and administration building at the entrance

Source: AVE Miskolc Ltd.

The three waste yards in Lórántffy Street, József Attila Street, and Bogáncs Street in Miskolc and the waste sorting plant in József Attila Street were established to ensure selective waste collection, the separation of green and other recyclable waste, and the collection of hazardous household materials. In order to optimise transport a waste transfer station was also built in József Attila Street in addition to the waste sorting plant and the waste yard.

During the preparation of the project the most advantageous locations of the different elements of the waste management system have been discussed at large for the distribution of the population concerned by the project is disproportionate. 70% of the nearly 267,000 people live in Miskolc and the remaining 30% in the other 36 villages belonging to the project. After due consideration of the environmental and economic factors as well as the distribution of the population, waste yards collecting hazardous communal waste were only created in Miskolc (under this project), while in the remaining 36 villages the operator collects the generated hazardous waste during the bulky waste collection process organised in intervals. It is important to emphasise that all the inhabitants of the consortium are allowed to use the three waste yards.

The distribution of the population concerned and the economic considerations justified the establishment of a transfer station in Miskolc as 70-80% of the waste to be dumped is generated in Miskolc and its immediate surroundings, and the Hejőpapi landfill is 30 km away from Miskolc. This transfer station was established in József Attila Street, adjacent to the waste yard and the sorting plant.

The closure and reclamation of the Miskolc-Nádasrét central landfill in Miskolc-Bogáncs Street and further 18 unsuitable or illegal dumps (Alsózsolca, Aszaló, Felsőzsolca, Emőd, Harsány, Hejőbába, Hernádnémeti, Mezőcsát, Miskolc-Muszkásoldal, Miskolc-Martintelep, Miskolc-Vologda, Nemesbikk, Ónod, Sajósenye-Boldva, Sajólád, Szirmabesenyő, Tiszapalkonya, Vatta) was realised step by step.

3. Costs and Realisation of the Project

From the planned costs, which amounted to 12.9 mil. EUR, 70% were to be paid by the ISPA programme of the European Union, 10% by the Hungarian government, and 20% by the municipality Miskolc. However, during the realisation period due to inflation, the low exchange rate of the Hungarian Forint etc., costs raised to 20.5 mil. EUR. As the amount of the EU was fixed, the Hungarian side, mostly the municipality, had to bear the additional costs (cf. Table 1).

Table 1. Project costs (in EUR)

Total Costs	Private sector contribution	Planned costs	Total eligible costs	EU (ISPA) grant	Extra costs without EU contribution
20,489,669.59	–	12,900,000	12,895,686.05	9,026,980.25	7,593,983.54

Source: Municipality of Miskolc.

The project had been accepted by the EU in November 2000 and was signed by the Hungarian partner in March 2001. The financial contract was signed on April 30, 2002. All procurement was carried out by public procurement in accordance to the EU regulations in order to avoid any bias. The execution tender and the FIDIC engineer tender were accepted in 2003, and the corresponding contracts were signed in November 2003. The machinery tender and the PR tender were accepted in 2004. The last purchasing was the equipment necessary for the operation of the system, such as steel containers, plastic waste containers, compactor, semi-mobile impact shredder and screening line for construction and demolition waste, tractionable general purpose pre-shredder, wheel loader, multi-functional vehicle with crane, waste collection vehicles, comminuters (a machine that shreds or pulverises), screening trommel and compost turner. Table 2 registers the objectives of the project as outlined in the application.

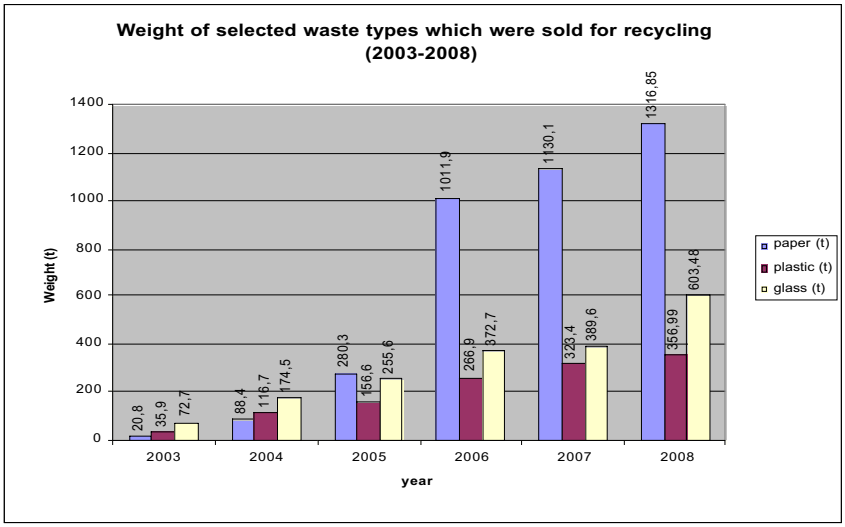
Table 2. Objectives (indicators) of the project

Indicator	Unit (m^3/m/ pc)	Quantity
Supply		
Waste yard containers	pc	51
Household bins	pc	2,280
Compactor	pc	1
Vehicles	pc	6
Waste transport vehicles	pc	3
Works Tender		
Waste yard	pc	3
Waste yard containers	pc	24
Transfer station (100,000 tpa licensed)	pc	1
Waste treatment plant		
Waste sorting plant (15,000ñ15,000 tpa)	pc	2
Composting plant (8,000 tpa)	pc	1
Regional landfill site		
Earthworks	m^3	448,000
Isolation (surfaces) – geotechnical liners	m^2	93,500
Gravel drainage and leachate collection system	pc	1
Biogas collection system	pc	1
Service and operating facilities		
Buildings (machine-shed, hazardous waste storage facility, social buildings, scale room, hydraulic engine room)	m^2	1,256
(Access) Road (I and II)	m	3,542
Inside and Service road (inside road, service road, car park and container storage)	m^2	13,500
Utilities	pc	13
Monitoring system	%	100%
Closure and reclamation	pc	19
Supervision	%	100%
Public relation	%	100%

Source: Municipality of Miskolc.

Figure 6 shows the growing amount of separated waste which was sold for recycling. Figures do not only prove the success of the technical and financial vision of the project but also the growing awareness of the citizens.

Figure 6. Weight of selected waste types sold for recycling 2003-2008



Source: Municipality of Miskolc.

4. New developments generated by the ISPA project

After the ISPA project was implemented, some very plausible "follow-up" activities or local best practices are pursued, including biogas utilisation, methanol processing from waste, and awareness rising.

Figure 7. Recultivated landfill in Bogáncs street, Miskolc

Source: Municipality of Miskolc.

Biogas Utilisation

In January 2009, a new step started in which biogas will be processed from the recultivated landfill. New biogas collection wells will be drilled as complementary wells to the existing 86 gas wells that were drilled at the reclamation. The processed biogas will be used for heating and will be connected with the existing district heating system. Beginning from 2010 right after the end of the heating season, a brand new gas engine will produce electricity from the biogas. The estimated volume of biogas is 250 m^3/hour, the estimated heating value is 22 MJ/m^3. This biogas untilisation will help to save energy and at the same time reduce CO_2 emission. The expected results are:

– natural gas saving: 377,330 m^3/year,
– production of 3,419,886 kWh "green" electricity, and
– CO_2 emission reducing: total 58,073 tons and 3,872 tons/year.

Methanol from Waste

Another possible direction which is discussed at present is to process methanol from waste. The arguments in this discussion are:

- the existence of a new technology awarded in 2008,
- a possible input of 2,000 tons/year mixed organic waste,
- a possible output of 600,000 kg/year methyl alcohol,
- processing of 133,000 kg/year liquid CO_2,
- avoiding CO_2 emmission – more emissions trading, and
- nearly 2,000 tons/year less waste dumped to the landfill.

Awareness Raising and Home Composting

As stated earlier, an important aim of the project was to reduce the amount of dumped waste and to enhance the inhabitants' readiness to separate waste. One basis for this development was of course to provide a well-enlarged system of collecting points. So an important step was to erect waste collecting points in Miskolc and in the other municipalities. Miskolc alone has 110 collecting points now, and in the neighbouring area with 70 settlements 122 collecting points for more than 150,000 citizens were established.

Another activity in this direction was the developement of a municipal composting programme, based on the following motives:

- minimising the amount of waste and by that avoiding additional pollution from transportation,
- ameliorating air quality as composting reduces garden fires, and
- improving soil quality by using compost instead of chemicals.

According to the composting programme every citizen can use 400 free composting boxes per year. Together with the boxes the user gets advise on how to compost and how to utilise the ready product.

In order to reduce dumped waste by separting and composting awareness raising was brought off. The first addressees in these actions were school children and their families.

5. Conclusion

The positive effects on environment and health protection are evident. As stated before, the expected parameters relating to the avoidance of air and soil pollution have been achieved. It is evident that solely the cooperation of the municipalities has enabled them to establish a modern, well-equipped regional waste management system. The voluntary association of municipalities appeares to be a successful way to elaborate stringent modernisation projects and to convince public funds to finance them.

Jochen C. Trommer

The ALBA Group as a Model for the Future – Modernisation of Municipal Waste Management in Central and Eastern European Countries through Private Public Partnership

1. The ALBA Group

Since January 2009, the ALBA and Interseroh groups of companies have cooperated as two independent pillars under the virtual roof formed by the ALBA Group. With combined sales of over 3 bil. EUR and an almost 9,000-strong workforce, they are one of Europe's biggest environmental services and raw materials providers with activities in Eastern Europe, the US, and Asia. In what follows, the ALBA Group will be introduced in more detail and the services housed under its virtual roof will be outlined.

The concept of "urban mining" turns a city into a raw materials mine. It involves the process of collecting, recovering, processing, and marketing raw materials. Waste is no longer waste but a key source of raw materials for use in industry, particularly in resource-poor Germany. A growing number of waste metals, plastics, and cardboards are finding their way back into the production cycle. The principles behind this closed cycle provide the basis for the ALBA Group's business idea – discarded waste serves as a valuable resource in production and avoids a further drain on existing stocks of natural resources.

Through close cooperation between Interseroh and ALBA, the two corporate groups cover the entire waste management, recycling, and reuse chain. Their fields of activity complement one another in making up the full range of services. Interseroh's core areas of expertise are steel and metal recycling, Germany's Dual System recycling scheme for sales packaging, as well as national and international trade in raw materials. ALBA provides waste management services, commercial waste collection, and facility services. Together, ALBA and Interseroh form the two pillars of the ALBA Group. Each pillar has a different set of responsibilities.

Be it packaging recycling or reuse of waste products, value creation can only occur with an approach that uses an integrated organisational concept and targeted quality management to produce high-quality raw materials for sale on the global market. Unlike natural resources, these modern raw materials are recovered less through the use of technology and more by organising and coordinating the relevant services. Together, ALBA and Interseroh create economically viable substance cycles to provide sustainable alternatives to industry, trade and retail, waste management providers and consumers, thus serving the environment in the process.

Axel Schweitzer, chairman of the board at Interseroh SE and member of the board at ALBA AG, describes the challenges and the targets of the company as follows: "The recycling and waste management sector will face increasing change: away from waste and towards raw materials. Given the ever-scarcer availability of natural resources, recycling and reuse takes on an ever-greater role, thus stepping up the need to secure a resource-efficient future. The ALBA Group wants to play its part in all of this. To do so, it must enhance available recycling technology and provide effective logistics. This means investing in new technologies and recycling processes. It also means that policy-makers in Germany and around Europe must give greater recognition to the waste management sector in its capacity as a raw materials sector. With the right statutory framework, the strategic role played by recycling and waste management companies will involve not only that of managing waste but also of supplying raw materials. With intelligent integration of ALBA and Interseroh activities, the ALBA Group can cover the entire value creation chain of collection, recovery, processing and marketing of raw materials. This provides optimal conditions under which to become the leading environmental services provider and raw materials supplier in Germany and, in the medium term, in Europe."

The special fields and activities of both groups in the waste management process will be described in the following.

2. ALBA: A Systematic Approach to Service

One pillar of the ALBA Group is formed by ALBA, which was founded in 1968 by Franz Josef Schweitzer. The family-owned enterprise, now run by his sons Axel and Eric Schweitzer, has made market-economy flexibility, performance and service, and customer relations the focal points of its corporate identity. The company's core operations comprise municipal and commercial waste management, marketing of secondary raw materials, development and sale of recycling and production systems, and design and implementation of facility services.

2.1 Waste Management

ALBA manages around 4 mil. tons of waste each year, channelling it into a highly efficient recycling and reuse system. At ALBA, waste management means far more than just taking waste away. The design and implementation of new ideas to benefit people and the environment also play an important role. As early as in 1973, the company introduced a waste separation system using different coloured bins (known as the Berlin model). After German reunification, the model soon spread beyond Berlin and took a hold around the country.

ALBA's latest innovative waste management model – the Yellow Bin^{plus} ("Gelbe Tonne^{plus}") – has been in operation in Berlin for over four years. It broadens the scope of the existing

dual system collection of packaging materials to include all dry recyclables. High quality, recyclable materials which up to now have landed in residual waste containers are now collected with packaging in the Yellow Bin^{plus} and are then channelled for recycling and reuse. These materials include old toasters and other small electrical appliances, pots and pans and tools made of metal, strips of wood, plastic bowls, and old toys made of plastic, wood, and metal. All of these can now be placed in the Yellow Bin^{plus}.

By providing separate collection of this "dry" waste which up to now has landed in people's grey bins, the Yellow Bin^{plus} serves to reduce the volume of costly residual waste. Some 410,000 homes with around 750,000 residents – almost all of Berlin's large apartment blocks – are covered by the Yellow Bin^{plus} system. In Leipzig, the Yellow Bin^{plus} is in operation throughout the city and is used by the approximately 511,000 inhabitants in its 293,000 households.

2.2 Serving Municipalities in Germany

The state, municipalities, and local communities face a wide range of challenges. Organisation and funding are two key areas of focus. As in all other sectors, ALBA concentrates on what is important.

In many districts and cities, the local authorities turn to ALBA's regional companies in matters concerning waste management. Synergies and shared use of available waste treatment and recycling capacities keep waste management within the realms of the affordable. Local authorities and the local public benefit from ALBA's vast experience. The use of Public Private Partnerships (PPPs) is growing in popularity: They bring lasting financial relief for public budgets and allow for leaner public institutions.

ALBA has operated PPP models in the German states of Mecklenburg West-Pomerania, Brandenburg, Saxony, Saxony-Anhalt, and Lower Saxony for many years. In cooperation with the City of Berlin cleaning services, ALBA operates two mechanical-physical stabilisation (MPS) plants to produce substitute fuels from waste. ALBA developed the technology used in this process.

2.3 Recyclables Trading

Apart from traditional waste management activities, ALBA is also active in the management of recyclables. ALBA's recyclables trading history goes back to 1994 when the market was purely a used-paper market. In the years that followed, activities came to include the provision of logistics and transport services, marketing and trade of plastics, glass, electrical and electronic waste, residual waste, substitute fuels, waste wood, waste carpets, and bulk waste. ALBA's recyclables trading operations also take in technological enhancement and management of its own facilities.

Within the ALBA Group, recyclables trading serves to reduce the drain on natural resources. By consolidating material flows, optimising transport, and marketing newly recovered materials, the recycling chain is perfected and the material cycle is closed.

2.4 Modern Technology Serving the Environment

ALBA's vast experience and technological expertise are instrumental in Germany's role as a market leader in environment technology. The company's future-oriented attitude and targeted pursuit of innovation make it a pioneer in the recycling and high technology sectors – a position achieved with the highest degree of environmental effectiveness and economic efficiency.

For example, the MPS process developed by ALBA and operated in Berlin allows up to 98% of residual waste to be recycled and reused as a substitute fuel in places such as cement factories and power plants. And this is done with considerable savings in CO_2 equivalents.

Alongside its residual waste management activities, ALBA has specialised in other sorting technologies. For example, in recent years ALBA has been responsible for developing Europe's most modern systems to recover plastics and other reusable materials from dual system waste collections (post-consumer packaging facilities) and to sort paper, board, and cardboard.

But ALBA's expertise goes beyond sorting and treatment technology. The Berlin-based company is a leading technology provider when it comes to the processing and recycling of plastics and glass. It is able to reuse more than 80% of the materials recovered using this technology. This high reuse quota illustrates how ALBA serves the environment by recycling waste and pursuing sustainable development.

2.5 Facility Services

ALBA's portfolio is rounded off by its facility services package which offers integrated solutions ranging from strategic facility management to operative implementation of broad-based activities. The company's facility services stretch from waste and facility management to energy contracting and logistics. This includes energy performance contracting for the Unfallkrankenhaus Berlin, an accident hospital, and the electronic materials supply and waste management system for the Daimler complex on Potsdamer Platz.

The ALBA Facility Services team comprises engineers, technicians, buyers, and sales staff from all key sectors. They all work hand in hand to provide clients with customised solutions.

3. Interseroh: Environmental Services Provider and Raw Materials Supplier

INTERSEROH SE is a listed company. With its headquarters in Cologne and over 100 outposts, it boasts a combined workforce of almost 2,000 employees. The main shareholders are ALBA's owners Axel and Eric Schweitzer, who hold a 75% share by means of asset management. The company is synonymous with high-quality, modern recycling. Interseroh guarantees the industry a secure supply of the valuable, globally traded secondary materials needed for production. In 2008, Interseroh supplied some 5.8 mil. tons of secondary raw materials and achieved sales amounting to 2.066 bil. EUR.

3.1 Heavyweight Recycling: Steel and Metals

Interseroh processes all types of waste steel and scrap metal, from soda cans to consumer waste to industrial salvage. In other words, meltable materials that can be processed for reuse in industry. Interseroh operates in Germany, Poland, and the Netherlands and has sales offices in several countries, including Sweden, China, and Hong Kong. With more than 3.7 mil. tons of treated and processed steel scrap, Interseroh ranks among the top three of its kind in Germany and is thus a major supplier to the steel and metal industries at home and throughout Europe.

Its scrap steel and metal comes from scrap merchants and waste management providers and also from companies that use and generate the type of materials involved. The scrap is then sold on to steel producers and smelters. Interseroh thus acts as an intermediary between scrap producers and scrap merchants, on the one hand, and the iron and steel industry on the other.

Interseroh recently expanded its international activities. At the end of August 2009, the first ocean-going vessel carrying 25,000 tons of scrap steel left the Dutch port of Dordrecht. An important step in broadening the reach of Interseroh's scrap business and in claiming new markets, this involved the consolidation of the company's non-ferrous metals business in Dortmund and increased exports of such materials.

3.2 Custom Service: Packaging Recycling with Interseroh

Be it furniture manufacturers, vegetable packagers, tile makers or shoe importers, all producers and sellers who place transport and sales packaging onto the German market or import it into Germany are subject to the comprehensive return and reuse requirements contained in Germany's packaging regulations.

Fulfilling these obligations is one of Interseroh's core activities. Over 6,000 industrial clients have commissioned Interseroh with taking back and recycling more than 1 mil. tons of transport packaging. Interseroh ensures collection at over 100,000 pick-up points and organises

the transport, sorting, and marketing of materials to some 300 recyclers. The logistics involved, meaning collection, transport, and sorting, are performed by 600 independent waste management companies under contract with Interseroh across Germany.

Since the emergence of this market, Interseroh has collected sales packaging from private end consumers as part of its constantly expanding Dual System Interseroh (DSI). Sectoral solutions were developed to meet the particularly stringent requirements of Germany's new packaging regulations. These apply to sales packaging which arises in places comparable to households, i.e. small crafts and trades businesses, cultural, sports and education facilities, hotels, canteens, and military barracks.

3.3 Interseroh: Full-Service Provider

Interseroh aims to offer clients a constantly improved service in conjunction with its various waste management systems. For example, companies subject to the requirements set out in Germany's packaging regulations can order services in addition to the collection and reuse of their transport and sales packaging. Interseroh Pfand GmbH organises the full package of logistics for used one-way drinks packaging on which a deposit is paid, deals with the clearing house, and manages the recycling and reuse of recovered secondary raw materials.

The range of services is enhanced by an in-house returns system for electrical and electronic waste. Paper sacks are also taken back, cleaned, and returned to the cycle. The same applies for used batteries and empty toner cartridges from printers, photocopiers, and fax machines.

Interseroh offers companies in the furniture industry, the bathrooms, heating, and air-conditioning sector, crafts and tradespeople, and filling stations a return and recycle service for a wide range of waste materials and for items such as furniture, washbasins, radiators, and pipes that they no longer have a need for.

Interseroh Pool System GmbH organises a hygienic recycling system for plastic fruit and vegetable crates used in the food trade. The unique logistics systems link shops and supermarkets directly with producers and consumers.

All Interseroh packaging return systems share the same approach: Collection, sorting, and recycling of packaging is guaranteed to be in line with Germany's Packaging Ordinance and to fulfil other statutory requirements such as documentation, testing, and verification by authorised experts, as well as reporting quantities to the German Chamber of Industry and Commerce (DIHK).

At the end of August 2009, INTERSEROH Dienstleistungs GmbH received the TÜV Rheinland Premium Service seal of quality with respect to its products and services, cost-benefit ratio, and customer support, making the company the first of its kind to receive such certification.

3.4 Raw Materials Supplier of Paper and Plastics

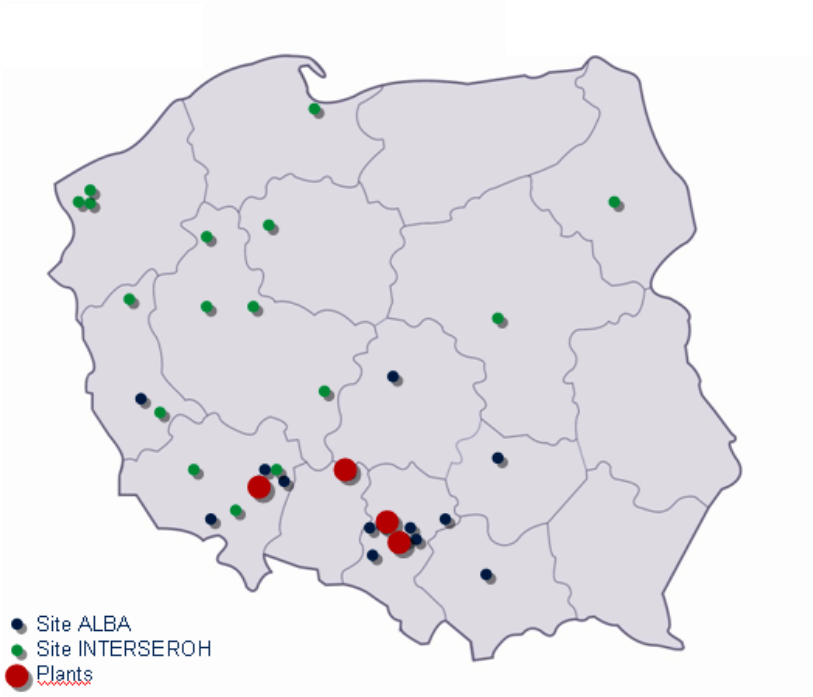
Interseroh consolidates waste paper and plastics into bulk quantities in order to channel them back into industrial production. Processing waste products and their transformation into usable secondary raw materials occur using modern recycling technology at Interseroh's own scrap yards or its woodyards which supply waste wood as a secondary raw material to both the timber industry and biomass-fuelled power plants. In conjunction with a plastics producer, Interseroh Rohstoffe GmbH has developed the first ever processes which allow recycled plastic to be made into high-quality products.

4. Serving Municipalities and Public Private Partnerships in Central and Eastern Europe – ALBA's Engagement in Poland

In Poland, the per capita generation of household waste is at around 270 kgs/year and rising. Compared to the German volume of around 570kgs/year it is obvious that there will be an additional demand for the collection and treatment of waste in the Polish market. Given the rising incomes and purchase power and therewith rising waste volumes, the challenge of the future will be the proper handling of these increasing quantities. The Polish public waste management installations including the public and private landfills are not well prepared for the fulfilment of European Union environmental standards that will have to be followed starting in 2010. The further engagement of private companies such as ALBA as a strategic partner for the public waste management system in Poland is a viable way in order to face these challenges. Even with the financial support of the European Union, the appropriate know-how and the capital market-driven efficiency of private waste management companies will be a driving force in this future market.

ALBA has been operating in the Polish waste management market as early as 1995 with the establishment of its first PPP in the region of Katowice. Communal waste management companies were at the time looking for strategic private partners for investment, know-how transfer, and the professionalisation of their services. Services for the public were generally undertaken by public institutions and in the hands of communes and municipalities. With its first engagement in the Polish market, ALBA proved itself a reliable partner for the public in Poland. Multiple additional investments followed in the years since then, and by now, ALBA has various levels of partnerships in the market, ranging from wholly owned foreign enterprises to joint ventures with the local communes. Both models have proven successful, depending on the stage of development of the waste management systems and regulatory challenges in the public system.

Figure 1. Sites of ALBA Group in Poland 2009



Source: ALBA Group.

In recent years ALBA acquired a leading role in the Polish waste management market. It holds plants in different fields as are household waste, substitute fuels, lightweight packaging, recycling of glass, paper and cardboard. The major fields of business are:

- municipal services,
- complex services & industrial clients,
- secondary materials sorting and trading,
- alternative fuels,
- winter & summer street maintenance, and
- facility management & green area service.

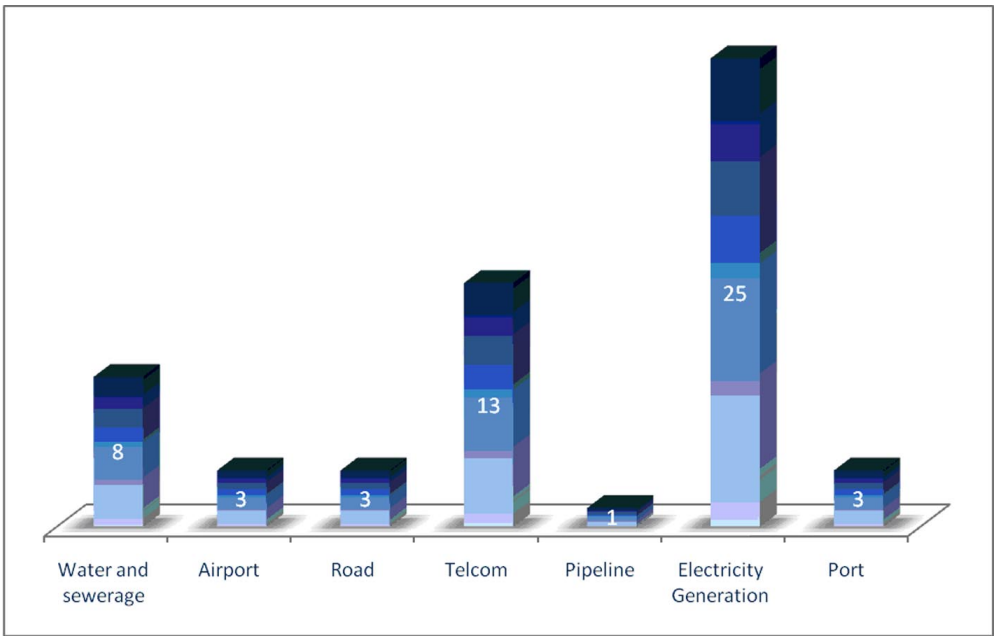
Since 2008, ALBA runs Poland's largest sorting plant for household waste in Wroclaw. The technical concept includes two lines, sorting mixed household waste as well as material from the selective collection systems. The plant received an investment of 8 mil. EUR, has a capacity of 140,000 tons, and offers jobs for 70 people.

Another example is the plant for the production of substitute fuels in the city of Chorzów near Katowice, which ALBA operates since 2008. Here, ALBA produces a high caloric substitute fuel out of household waste and the selective system collection. This engagement is assessed as an ecologically highly innovative process for the treatment of household waste.

The recycling quota is up to 99%. The investment was 1 mil. EUR and the capacity is up to 30,000 tons. The plant has 10 employees.

As shown in Table 1, infrastructural PPPs were limited until the end of 2008 due to multiple reasons, with the most important one being the complex and time-consuming paper work to be undertaken.

Table 1: Private public partnership projects in public services in Poland



Source: http://ppi.worldbank.org, own illustration, Data until end of 2008.

With the new Act on Public Private Partnership in 2009 a significant simplification of procedures and regulations has been achieved. The huge demand for infrastructural projects such as roads and highways, transportation, airports, and the surrounding infrastructure for the European Football Championship 2012 in Poland and Ukraine will enforce the cooperation between private and public entities. With the new EU Waste Management Directives to be followed, this trend will be found in the sector of public sanitation and waste management as well.

One of the major challenges of the future for private environmental service providers such as the ALBA Group in Poland and Central-Eastern Europe is the efficient and value-creating development and operation of collection and treatment systems in accordance with EU standards. This challenge has to be faced under the pressure of comparably low fees paid for these services by the public and individual households. One of the significant benefits of private companies in these markets is their long-time experience and their management and operational know how in the successful execution of services for the public.

3 MODERNISING INFRASTRUCTURE IN THE FIELD OF WATER AND WASTEWATER

Vasile Ciomos

Modernising Municipal Water and Wastewater Treatment Systems in the Context of the EU Environmental Policy

Abstract:

The Romanian water sector is a very challenging environment that illustrates the situation of Central and Eastern European Countries (CEEC) after the major political turnaround in the region at the end of the last century. All relevant public stockholders are committed to providing water supply and wastewater services in line with European Union practices and policies in most urban areas by 2015. This paper will present a number of issues (policies, reforms, investments, and research) related to modernising municipal water systems in the context of EU environmental policy.
Keywords: Institutional reform, water sector, A-Port research project, Romania

1. Background

Romania is an average-sized country compared with other European Union members and has an area of 238,391 km^2 and a population of about 21 mil. inhabitants. 97.8% of Romania's hydrographical network belongs to the Danube River Basin. Around 38% of the Danube's length flows through the southern part of the country and creates an important natural heritage – the Danube Delta.

At the beginning of the reform process, which Romania entered after 1989, the country was in a very difficult starting situation. With regard to the water sector, Romania's water infrastructure was in very bad shape with low levels of accessibility to piped water systems and very limited waste water treatment. The quality of drinking water quality was not monitored, no metering was done, and huge amounts of energy were consumed. On the part of official authorities, no specific legislation on water supply or waste water treatment had been enacted and a lack of transparency and inadequate accountability characterised the situation. Due to low levels of fees and tariffs, the revenues did not cover the costs.

In terms of ***water supply***, Romania has implemented a series of challenging reforms in the last 20 years. After half a century of centralised management, Romania decided to return to the principle of local autonomy in the early 1990s, transferring responsibilities to local administrations. One of them referred specifically to the Law on Local Public Administration which gives them back their right and obligation to organise and operate water services effectively and appropriately.

With the concentrated efforts for the decentralisation of public administration, about 270 of the 300 urban localities in Romania have been confronted with shortages in financing the

water sector, both in terms of maintenance and operation of systems, especially with regard to modernisation and expansion. They have failed to obtain any funding from international financing institutions (IFIs) or from the private sector.

Due to this lack of funds, these 270 cities have made very little investment over the past 20 years to maintain and develop an infrastructure for the provision of water and waste water services. Consequently, the systems are in very poor condition. Some of the major problems related to water services in small agglomerations include:

- inadequate maintenance and operation,
- increased number of leaks in the network and a low-level collection fees from consumers,
- lack of investment on the rehabilitation and extension of the infrastructure for providing water/waste water,
- lack of specialised staff for the preparation, management, and implementation of major investment projects,
- inadequate management of operational expenditure,
- lack of clarity relating to the roles and responsibilities of the institutions/authorities involved in the management of public utilities, and
- deficient institutional framework.

The 30 cities with a population of over 100,000 inhabitants each that have benefited from some investment programmes with external support (EU grants and IFIs loans) have partially rehabilitated the water and waste water infrastructure to assure acceptable levels of service quality. Two large municipalities (Bucharest and Ploiesti) signed concession contracts with private operators in 2000 and have thus managed to attract some foreign capital needed to finance the infrastructure.

By these means, approximately 50% of the country's urban population has benefited from investment programmes in the water sector. But these investments are not sufficient for a sustainable development of water services and to fully comply with EU Directives (see Ciomos, Zaharia, Danciu 2009). Conversely, half of the urban population and 80% of the population in rural areas feel an acute need for better quality services, and therefore further substantial investments are needed (cf. Tables 1 and 2). The necessary investment is estimated at about 20 bil. EUR for the next ten years.

Table 1. Supply of water and wastewater systems in Romanian urban areas 2009

Length of streets with network (length of the street/ %)	Number of towns with water distribution systems	Number of towns with sewerage systems
under 10	17	59
10-20	18	56
20-30	25	36
30-50	36	65
50-75	81	60
over 75	137	38

Source: Romanian Water Association.

Table 2. Supply of water and wastewater systems in Romanian rural areas 2009

	Number of communities with water supply systems		Number of communities with sewerage systems	
	Rural communities (number)	%	Rural communities (number)	%
Total	1551	54	373	13
R. North-East	242	48	86	17
R. South-East	267	76	50	14
R. South-Muntenia	258	51	46	9
R. South-West Oltenia	134	33	19	5
R. West	159	58	43	15
R. North –West	282	71	61	15
R. Middle	197	56	56	16
R. Bucharest-Ilfov	15	43	12	3

Source: Romanian Water Association.

Given the large volume of investment requirements to conform to European standards resulting from the engagements of Romania, the need for new actions has increased. Consequently a new institutional model has been designed and is currently under implementation.

2. The Reform Process

One of the key points of the reform process is the definition of the relationship between local authorities, as owners of assets, and operators. This relationship will be based on a commercial contract for delegated services in accordance with the provisions of Romanian legislation. The beneficiaries/local authorities will enter into concession contracts either with experienced utilities operators that have a proven record of capacity to prepare and implement investments of the size proposed in the programme, or with new regional operators formed by the grouping of in place operators. This so-called Regional Operating Company (ROC) will be contracted by the municipalities to operate in place infrastructure and manage investments.

Together with the discipline of a legal framework, the intention of the Romanian government has been to group a large number of weak service providers to a limited number of big and strong operators that are capable of providing better services at affordable levels of tariffs which ensure full cost recovery and loan reimbursement for local authorities.

The municipalities included in the programme will pool together in Associations of Municipalities (AoM), thus representing a collaborative structure which will allow the beneficiary local authorities to monitor and supervise the implementation of the rehabilitation and modernisation works more efficiently, as well as the performance of the Regional Operator. To this end, a Management Support Unit (MSU) will be established at the level of each AoM in order to act as the representative of the association and to monitor the financial and operational performance of the ROCs via the concession contract.

An institution building project has been implemented for the purpose of assisting the local beneficiaries (AoMs and ROCs) to achieve the overarching objectives, consisting of the creation of efficient water and wastewater service operators and of strengthening the capacity of the local authority to monitor their activities effectively.

Due to their poor financial situation, operators from small and medium size towns cannot carry out rehabilitation and development programmes for water and sewerage systems on their own, which is why they end up in this difficult situation when they have to operate old and inefficient systems.

The only viable solution identified and proposed via the national strategy was to set up strong ROCs, organised around hydrographical basins, which will take over the service from these towns in order to develop them further.

Many changes have been implemented during the 20 years of reforms. The following Table 3 shows the most important changes in the institutional level:

Table 3. Developments 1990-2009: Institutional aspects

1990	2009
Autonomous regias	Commercial Companies
One shareholder (local authority)	Many Shareholders (counties, towns, communities)
No specific legislation	Primary legislation Secondary legislation Tertiary legislation
Direct “management” (political influence in management)	Delegated management Concession contract (political influence is much lower)
No long term planning in place	Master Plans Business Plans, Action Plans

Source: Romanian Water Association.

The substantial improvement of the technical infrastructure that took place since the year 1990 is shown in Table 4:

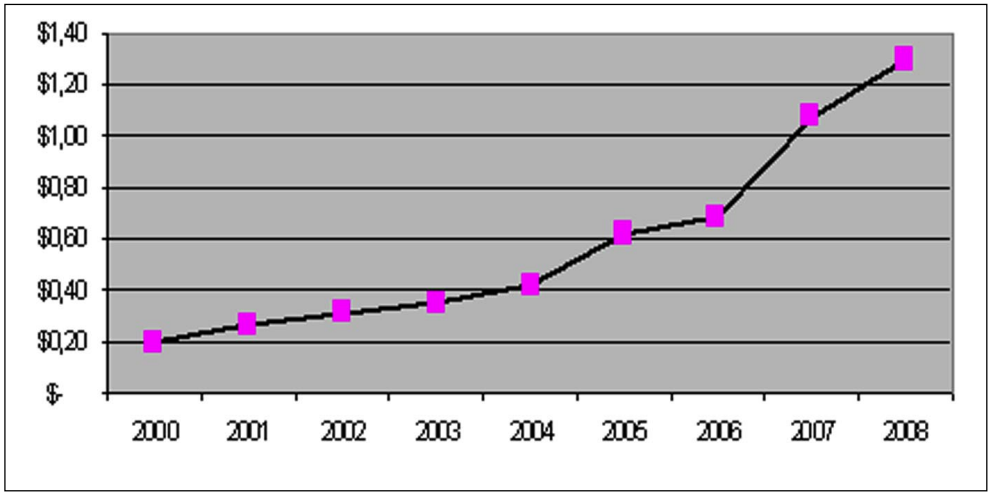
Table 4. Developments 1990-2009: Technical aspects

1990	2009
Length of the water distribution network: ~27,000 km	Length of the water distribution network: ~56,000 km
Length of the sewerage network: ~13,500 km	Length of the sewerage network: ~20,365 km
Specific residential consumption 350 l per day/capita	Specific residential consumption 126 l per day/capita impacting on revenue
63% access to piped water supply 2,500 mil. m^3 annual consumption	70% access to piped water supply 700 mil. m^3 domestic annual consumption

Source: Romanian Water Association.

Another field of substantial reforms were tariffs. While in 1990, Romania had used differential tariffs for the population, public institutions, and industry, the country has moved to unified tariffs for all these user categories by 2009 and is implementing the "polluter pays" principle. Moreover, while the low tariffs used to generate a lack of revenue 20 years ago, the tariffs today cover the operational costs and partly the investment needs. Another important difference concerns the role of the state: Whereas no private involvement took place in 1990, a few public-private partnerships have been established by 2009, for example in Bucharest and Ploiesti. As a result of the reform process the average revenue in the field of water and wastewater increased from 0.20 USD per m^3 in 2000 up to 1.30 USD per m^3 in 2008 (cf. Fig 1).

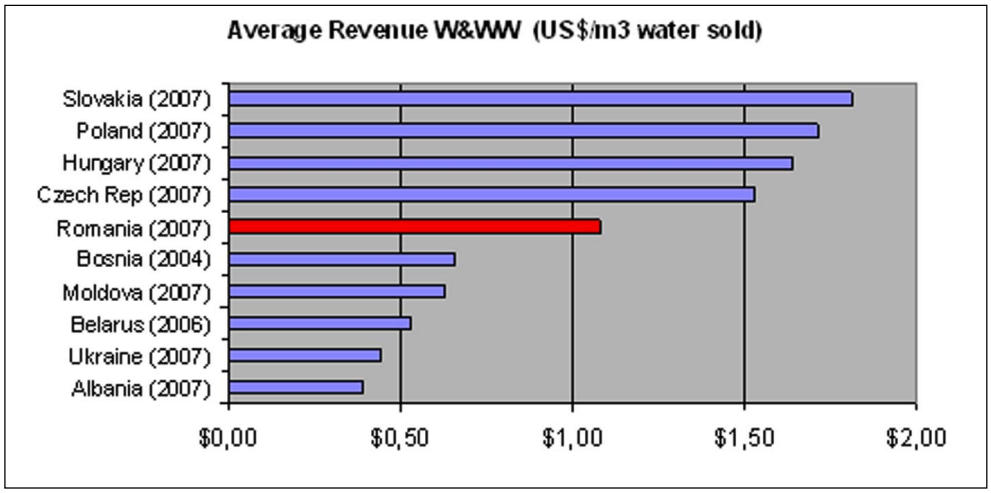
Figure 1. Development of average revenue in field of water and wastewater
(USD/m^3 water sold)



Source: Romanian Water Association.

Compared to other Central and Eastern European EU Member States Romania's average revenue in the water and wastewater sector is still arrears (cf. Fig. 2).

Figure 2. Development of average revenue in the field of water and wastewater in Central and Eastern Europe (USD/m^3 water sold)



Source: Romanian Water Association.

3. The Changes to Meet European Standards

Romania's accession to the European Union took place in January 2007. The harmonisation of the Romanian legislation with EU legislation has become a legal obligation for Romania resulting from the Accession Treaty.

Furthermore, meeting the requirements of the EU Sustainable Development Strategy is built into the Romanian National Strategy officially approved in November 2008, which settled the following strategic objectives:

- Horizon 2013: To incorporate the principles and practices of sustainable development in all programmes and public policies of Romania as an EU Member State,
- Horizon 2020: To reach the current average level of EU countries for the main indicators of sustainable development, and
- Horizon 2030: To get significantly close to the average performance of the EU Member States in that year in terms of sustainable development indicators.

The compliance timeframe settled in the Accession Treaty regarding municipal wastewater collection and discharge is set for 263 municipalities having more than 10,000 inhabitants until 2015 and for 2,346 smaller towns having between 2,000 and 10,000 inhabitants until 2018. 2015 is the target year for complying with EU drinking water quality standards.

On the other hand, the specific objectives are stipulated in the Sectorial Operational Programme Environment 2007-2013:
- to improve the quality of and access to the water and wastewater infrastructure,
- to provide safe potable water and sewerage services to the majority of urban areas, and
- to establish efficient regional operating structures for water and wastewater management.

In order to achieve these objectives a number of investment programmes are currently being implemented:
- ISPA > 1 bil. EUR,
- SAMTID ~ 100 mil. EUR,
- Integrated Control of Nutrient Pollution – 60 mil. USD.

Some other important investments are coming up under the framework of the Cohesion Funds (SOP Environment):
- 10 applications have already been approved by the European Community in 2008-2009 for more than 1.1 bil. EUR,
- 10 applications are planned to be submitted in the next few months (~ 1 bil. EUR), and
- 23 feasibility studies are almost finalised.

4. Conclusions

In order to meet European requirements, investments of significant magnitude are necessary to provide acceptable and affordable water and wastewater services for the Romanian population (20 bil. EUR). These investments are planned to be ensured through EU grants, loans from IFIs and commercial loans, as well as state budget and local budget contributions.

Since the EU's financial support is limited, it is important to tap the other sources. The country also needs to improve its operational performance. Innovative and efficient water management structures are needed to improve the operating efficiency as well as to prepare and implement large investment plans (delegated management, association of municipalities). In Romania, the regionalisation of utilities is a key element in improving the quality and cost efficiency of local water services. The new regional investment projects will firstly address the needs in urban agglomerations where the environmental impact is usually higher and the beneficiary population is also more numerous.

Currently, associations of neighbouring urban localities, which aim at attracting international funds for their investment needs in the water sector, are already a trend in Romania.
Romania's rural areas will continue to receive governmental and EU support, and in the medium term they will join the regionalisation process in order to ensure that the new facilities are adequately operated.

In terms of systems, Romania has implemented a series of challenging reforms. In order to support this process research activities are under development. A reference point for the

water sector is to redefine the relationships between the citizens (as final beneficiaries), local authorities (as public assets owners), and utilities (specialised professional organisations that are autonomous from a legal point of view). The research project (A-Port) is currently being developed with the aim to define a statistical model for measuring the customers' satisfaction related to water supply services. The transparency of the citizens' perception regarding the quality of the specific water service could be a pressure factor for the effectiveness and the efficiency of the local public administration towards the management of water resources. This way, the citizen becomes an active and permanent participant in planning investments and measuring the efficiency of local management.

References

Ciomos, V., Zaharia, V., Danciu, R. (2009), How Can the Private Sector Contribute to Improved Water Efficiency? *Metalurgia International,* No. 11/2009, Bucharest.

Muresan M., Ciomos, V., Turdeanu, M. (2008), Virtual Water Quality Barometer*, Revista de management şi inginerie economică,* No. 2/2008, Cluj-Napoca, available at: www.amier.ro, accessed January 20, 2010.

Sectorial Operational Programme Environment 2007-2013, available at: www.mmediu.ro, accessed January 20, 2010.

Dieter Bryniok

Technical Solutions for the Modernisation of Water and Wastewater Treatment Systems

1. Fraunhofer Water Systems Alliance

The Fraunhofer Water Systems Alliance was founded in 2007 by 14 Fraunhofer Institutes at 13 locations to pool their skills in the development of water system technologies. Taking into consideration the social, economic and ecological consequences, as well as climate change, demographic change, and migration, the Alliance aims to transfer sustainable solutions for water supply, infrastructure, and wastewater management to practise-oriented, national and international applications, and to contribute to the achievement of the United Nations' "Millennium Development Goals". A further objective is the systemic cross-linking of the resource water with energy, waste and agriculture.

The technology portfolio of the alliance and the member institutes covers more or less every aspect of water management and water treatment such as

- membrane technologies,
- electrochemical technologies,
- desalination,
- disinfection,
- chemical processes,
- bio processes,
- mechanical technologies,
- sensor technology,
- measurement and control technology, and
- design and installation engineering.

Services for industrial and public clients are primarily research and development services and pilot applications, which are performed in collaborative, publically funded projects, or bilaterally in industrial contract research. Additional services are strategy development, analyses, consulting, conceptual design, and scheduling in the fields of water supply, infrastructure development, and wastewater treatment.

The most important fields of research and development services of the Alliance and the member institutes include:

- analysis and assessment of water management systems,
- demands for water infrastructure systems to meet climatic and demographic changes,
- security and safety,
- technology preview and safeguarding for the future,
- development of new water technologies,

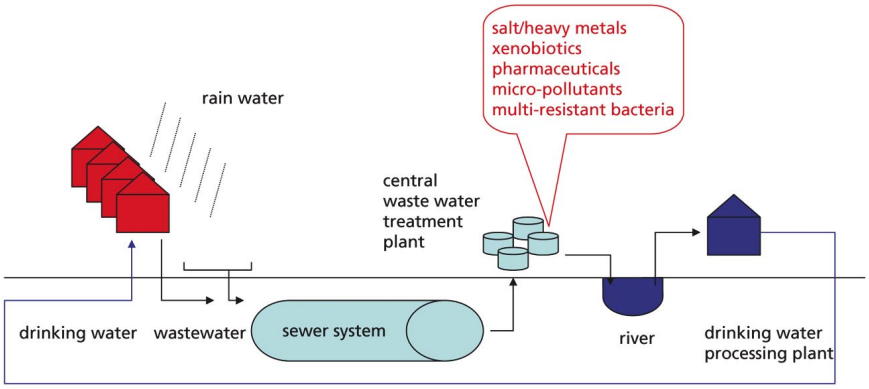
- pilot applications in industrialized and developing countries,
- conception and design of sustainable water infrastructure systems,
- conception and design of integrated urban infrastructures (water, energy, waste, transportation, communication),
- development of integrated management and decision support systems, and
- market analyses and market development.

Hence the Fraunhofer Water Systems Alliance is an excellent contact point for any issue related to innovative water management and water technologies.

2. Urban Water Management Systems

One of the most important common fields of activity of the Alliance is the development of sustainable, regenerative semi-decentralised water management systems to overcome the disadvantages of conventional urban water infrastructure systems (cf. Fig. 1).

Figure 1. Conventional water infrastructure systems in industrialised countries



Source: Fraunhofer Water Systems Alliance.

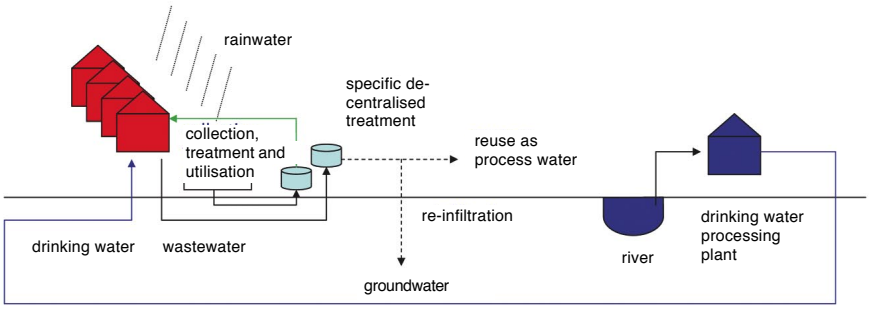
Conventional water infrastructure systems in industrialised countries are centralised, non-sustainable, not regenerative single use systems: Drinking water is produced from ground water or surface water in water utilities and provided to the households. After use for any purpose, it is discharged into the sewer system, independent of the grade of pollution. Rain water is collected and also discharged into the sewer system without any utilisation. After collection in sewer mains the wastewater is purified in centralised wastewater treatment plants beyond the cities and discharged after treatment into surface waters. So called "micro-pollutants," pharmaceuticals, xenobiotics, salts, heavy metals, and even pathogens are not removed efficiently from the wastewater, discharged into the surface waters, and need to be removed when drinking water is produced from surface waters.

Only 1-3 litres of water per person and day are really used as drinking water, while the total water demand for example in Germany averages about 125 litre per person and day. About 1.5 litre of heavily polluted wastewater per person are produced daily, which is diluted about 180fold by water from toilet flushing, bath, shower, kitchen, and others, and also by rainwater, which is collected and also discharged into the sewers.

The sewer systems mostly are gravity systems, which are dimensioned not only for the transport of wastewater, but also for the drainage of storm water and flood protection. The consequence is that the towns need huge sewer systems, whose total length for example in Germany sums up to about 400,000 km at investment costs of 150,000 to 250,000 EUR per km. Moreover, the sewer network in Germany is outdated, partially more than 100 years old, heavily in need of repair, and to a great extent under-dimensioned, due to increasingly heavy rainfalls as a result of climate change. The demand of reconstruction is estimated to about 55 bil. EUR in Germany for the next ten years.

Therefore this kind of conventional centralised water infrastructure cannot be the model for developing and emerging countries and especially not for arid and semi-arid regions. That is why Fraunhofer developed a sustainable and regenerative decentralised urban infrastructure system, which is being demonstrated in a model project called DEUS21 (cf. Fig. 2, 3) in the municipality of Knittlingen near Stuttgart in Germany in a development area with finally about 100 single family houses.

Figure 2. Decentralised Urban Infrastructure System DEUS21



Source: Fraunhofer Water Systems Alliance.

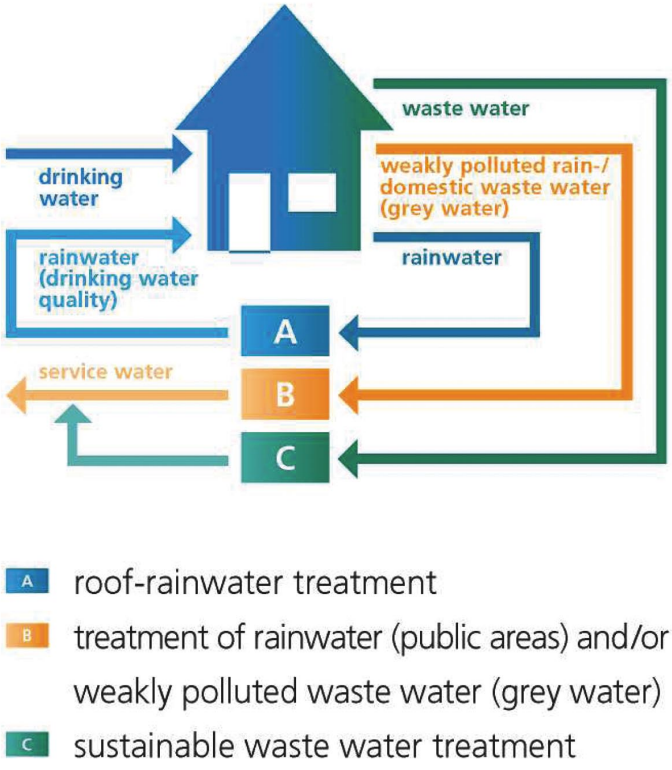
In the Decentralised Urban Infrastructure System the households are supplied with drinking water and service water generated from rainwater which is collected from the roofs and processed for applications, that do not need drinking water quality, like e. g. laundry and cleansing. Wastewater is collected separately from rainwater and treated in compact decentralised wastewater treatment plants to a grade that allows infiltration or the reuse of the water as industrial process water or for irrigation. Since the treated water is not discharged

directly to surface waters, the contamination of raw water in water supply works can be prevented easily.

The DEUS21 concept is based on several technological modules which partly are commercially available and partly have been developed by Fraunhofer and are continuously improved in demonstration projects. The most important elements are:

- separation of rain water and waste water,
- rain water collection, treatment, and utilisation,
- vacuum sewers,
- anaerobic membrane bioreactor and biogas production,
- rotating disc filters,
- co-digestion of organic wastes,
- biogas utilisation in a combined heat and power plant,
- recovery of nutrients (nitrogen and phosphor),
- re-use of treated wastewater as process water, for irrigation or infiltration, and
- use of digested residual solids as organic fertiliser.

Figure 3. Water cycles in the DEUS21 concept



Source: Fraunhofer Water Systems Alliance.

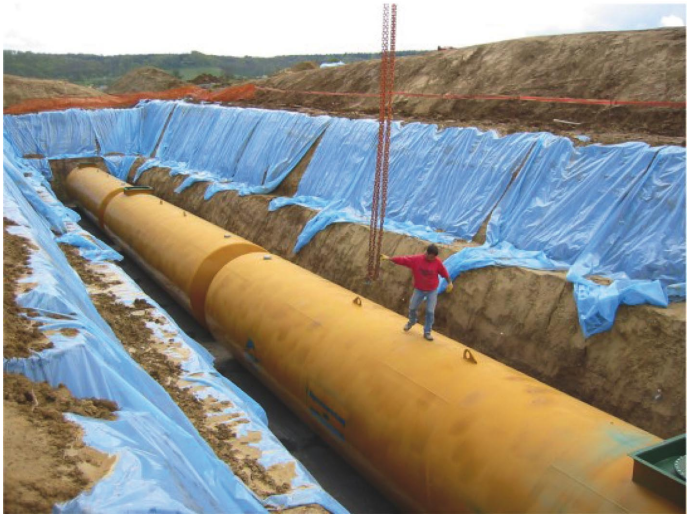
The rainwater and wastewater treatment devices are completely located in the so-called "water house" (cf. Fig. 4) in the centre of the new settlement and are operated without any noise or odour nuisance for the inhabitants.

In the following chapters some of the most important modules of the DEUS21 concept are explained.

Figure 4. "Water House" at the DEUS21 demonstration site in Knittligen/Germany

Source: Fraunhofer Water Systems Alliance.

Figure 5. Rainwater storage tank during infrastructure provision works at the DEUS21 demonstration site in Knittlingen/Germany



Source: Fraunhofer Water Systems Alliance.

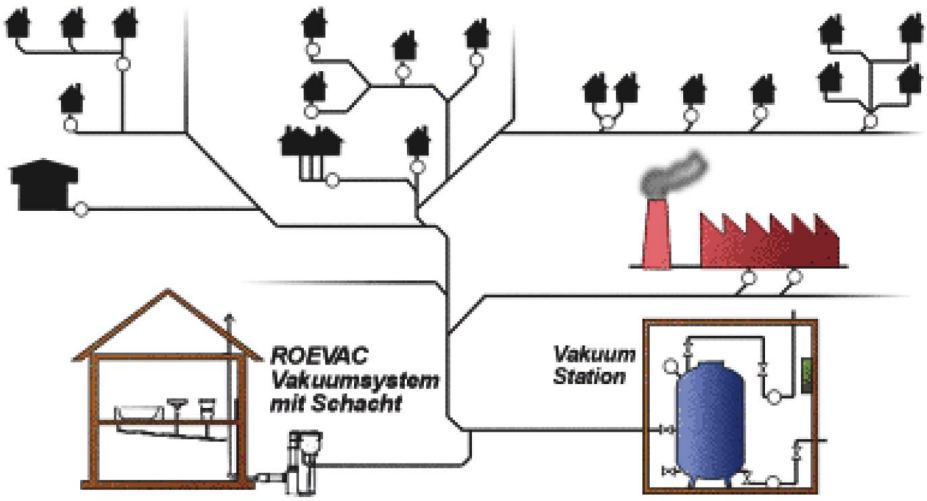
3. Vacuum Sewer System

Vacuum sewer systems are commercially available and are known from aircrafts and high-speed railway trains. In the DEUS21 demonstration project in Knittlingen/Germany, the vacuum sewer system (cf. Fig. 6) was delivered by Roediger Vacuum GmbH.

The owners of the houses in the development area have the choice between conventional toilets and vacuum toilets, which are designed for households. Each house is equipped with a wastewater collection tank which is connected to and emptied out into the vacuum sewer system. The wastewater is transported through comparably fine plastic tubes (cf. Fig. 8) into a central vacuum station located in the basement (cf. Fig. 7) of the water house. The central vacuum tank serves as a storage tank for the wastewater treatment in bioreactors.

The advantages of the vacuum system are reduced investment costs compared to large gravity sewer systems with high diameter tubing, reduced effort for maintenance and repair, and the possibility to transport highly polluted wastewater without dilution for gravity transportation. Additionally, kitchen wastes are added to the sewer system through macerators, which are integrated into each kitchen in the development area.

Figure 6. Scheme of the vacuum sewer system



Source: Roediger Vacuum GmbH.

Figure 7. Vacuum station in the basement of the water house at the DEUS21 demonstration site in Knittlingen/Germany

Source: Fraunhofer Water Systems Alliance.

Figure 8. Vacuum sewer pipes during laying at the DEUS21 demonstration site in Knittlingen/Germany

Source: Fraunhofer Water Systems Alliance.

4. Membrane Bioreactor

Due to the DEUS21 concept the treated wastewater shall be re-used. Therefore it needs to be cleaned to the degree which is necessary for the specific utilisation.

Since the organic load of the wastewater is very high due to the use of the vacuum system and the addition of kitchen wastes and other organic wastes, anaerobic wastewater bio-treatment is the most appropriate alternative.

At the demonstration site in Knittlingen, modular high performance membrane bio-reactors, which have been developed in the Fraunhofer IGB, are used for the anaerobic wastewater bio-treatment. In these reactors the organic carbon of the wastewater is transformed into biogas with more than 60% of methane, which can be utilised as bio-fuel in combined heat and power plants. The COD of the wastewater is reduced reliably to values below 100 mg/l.

Additionally, the recovery of nutrients like ammonium and phosphor from the treated wastewater are developed to a technically reliable process, and the solid residuals after anaerobic bio-treatment may be used as organic fertilizer.

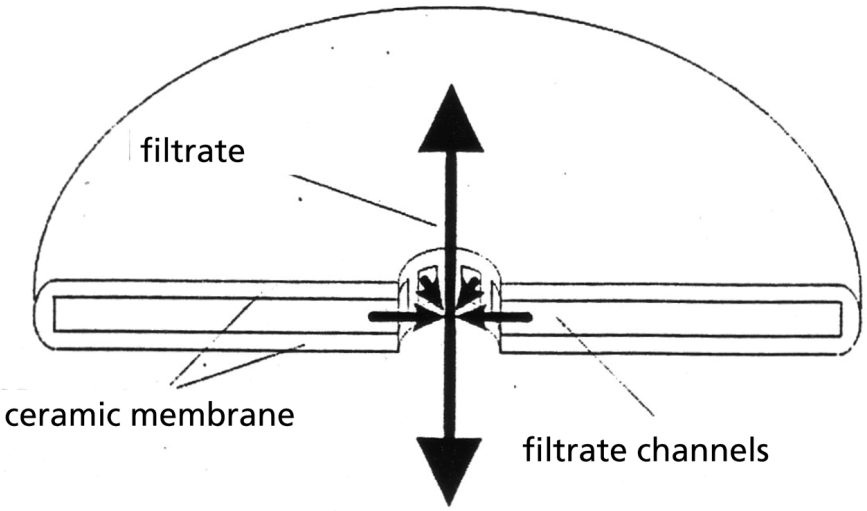
5. Rotating Disc Filter

The bio-reactors are combined with membrane filtration units to separate solids, including primarily active biomass, from the water and to feed it back into the bio-reactor. By this technique the concentration of active biomass and the turnover rates in the bio-reactor increase and the essential residence time can be reduced, as well as reactor volume and investment costs.

Membrane filtration of highly concentrated sludges like sewage sludge or digester sludge from biogas plants or anaerobic bio-reactors is technically most challenging, since the lifetime of membranes is heavily limited by the formation of surface layers which reduce the trans-membrane flux dramatically. This fouling effect is avoided in the rotating disc filter (cf. Fig. 10, 11), a dynamic filtration technology that has been developed in the Fraunhofer IGB.

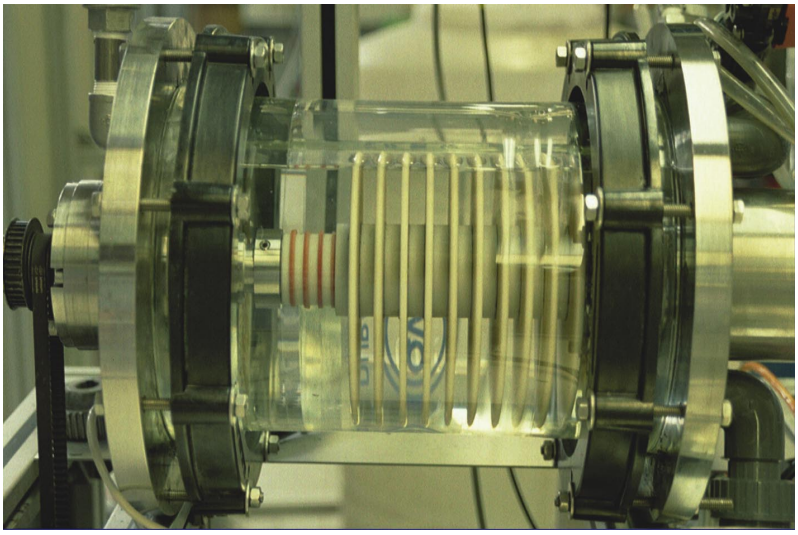
The sludge is filtrated through ceramic micro-filtration or ultra-filtration filter discs (cf. Fig. 9) which are available with a pore size of 20-200 μm. These filter discs are rotating in the filter and the solids are continuously removed from the membrane surface by centrifugal forces with a relatively low energy demand.

Figure 9. Ceramic filter disc



Source: Fraunhofer Water Systems Alliance.

Figure 10. Rotating disc Filter, laboratory model



Source: Fraunhofer Water Systems Alliance.

Figure 11. Rotating disc filter: Bellmer Fine Filter

Source: Fraunhofer Water Systems Alliance.

6. Conclusion

The DEUS21 water infrastructure concept goes far beyond the conventional water infrastructure system in terms of sustainability, use, and re-use of water and energy. Regarding economical aspects the DEUS21 concept is a framework of cost reduction.

Investment costs are reduced by decentralisation, by the change from gravity sewers to vacuum sewers, by the reduction of wastewater volume, and by the increase of the volume-time yields of the bio-reactors.

Operating costs are reduced by the increase of the pollutants' concentrations by rain water separation, by the reduction of drinking water consume, by the change from aerobic to anaerobic biology, and by the addition of kitchen wastes and other organic wastes to increase the organic load and the biogas yield.

The concept is of high interest especially for emerging countries with insufficient water infrastructure and lack of safe water resources.

Raymond Hernandez, Steffen Thomas Zagermann

Modernising Municipal Water and Wastewater Treatment through Public Private Partnership in Cheb, Czech Republic

1. General Information on Water Supply and Wastewater Treatment in the Czech Republic

The Czech Republic is called the "roof of Europe" as it lies on the continental divide. Rivers rising in the Czech Republic flow into three seas: the Baltic Sea, the North Sea, and the Black Sea. The longest river is the Vltava which is 430 km in length. The second longest river and the largest river in terms of volume is the Elbe River.

On the Czech territory there are several hot and cold mineral springs used in spas or as therapeutic drinking water. However, the Czech Republic does not have many lakes. The largest and deepest of these is the Black Lake in the Bohemian Forest. On the other hand, the territory is full of ponds and dams as well as water reservoirs serving for fish breeding, relaxation, and water regulation.

Water is perceived as natural wealth and a fundamental part of the environment, which must be used reasonably and protected as well as preserved for future generations at a sufficient quality and quantity.

Figure 1. Map of the Czech Republic

Source: CHEVAK Cheb.

The universal objective of the national water management policy is to create conditions for sustainable management of the finite water resources in the Czech Republic. This implies that all forms of water use should be in compliance with water and aquatic ecosystem protection guidelines while applying measures to reduce the harmful effects of water. The key principles of the water management policy are derived from the EU Water Framework Directive, other water management directives, and the renewed EU Sustainable Development Strategy.

Table 1 gives some general information on the water supply system and sewerage system in the Czech Republic.

Table 1. Water supply system and sewerage system in the Czech Republic – general information

1. WATER SUPPLY SYSTEMS

Territory, region	Population			Length of water supply systems (km)	Number of water supply systems	
	Mid-year population (persons)	Supplied with water from water supply systems (WSS) (persons)	Share of popuation. supplied with water from WSS (%)		Total	incl.: Group water supply systems
Česká republika	**10 429 692**	**9 664 179**	**92.7**	**72 167**	**4 449**	**1 046**

2. SEWERAGE SYSTEMS

Territory, region	Mid-year population (persons)	Living in houses connected to sewerage systems (persons)	Share of population living in houses connected to sewerage systems (%)	Population living in houses connected to sewerage systems with wastewater treatment plants		
				Total	Primary treatment	Secondary treatment
Česká republika	**10 429 692**	**8 459 215**	**81.1**	**7 897 824**	**20 182**	**7 877 642**

Source: Ministry of Agriculture of the Czech Republic.

The Water Protection Department of the Ministry of the Environment is the central water management authority in particular with respect to the following issues:
- conservation of quantity and quality of surface water and groundwater,
- flood prevention,
- water planning at the national and international levels, including programmes of measures,
- international cooperation in water protection,

- economic, financial, and administrative instruments in water protection, and
- drafting of legislation and standards in water protection.

Other characteristics of the present water supply system and sewerage system in the Czech Republic are:
- existence of a merged water supply system/sewerage system,
- water consumption: ~ 94.1 l per inhabitant per day,
- prices can vary to a great extent depending on the region,
- water losses: 15-30%,
- extent of water connections 92.7%; of wastewater connections 81.1%.

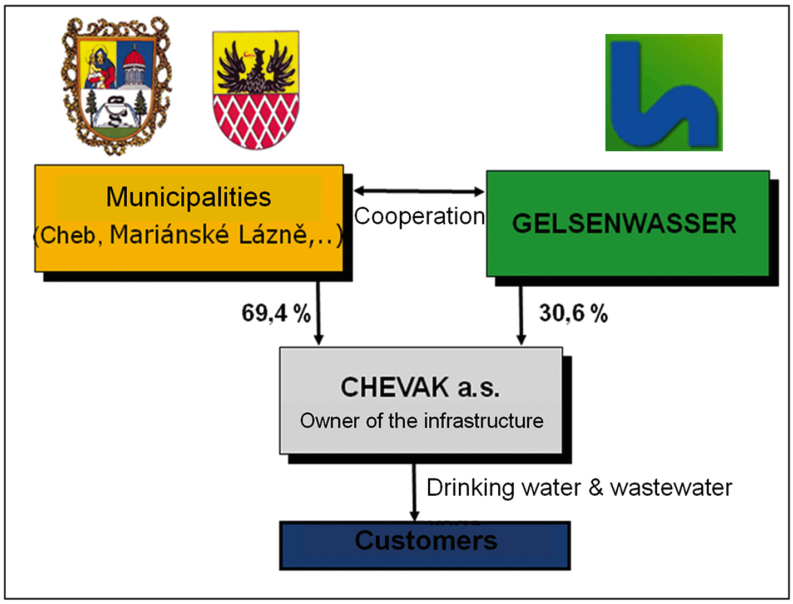
In the Czech Republic, the water supply and the sewerage system operations are provided by 234 companies (usually joint-stock companies or limited companies) and 1463 municipalities independently.

2. Cooperation with GELSENWASSER in the Czech Republic

Due to the passage of new legislation in accordance with EU directives on water and wastewater quality and the resulting innovation investments, many public utility companies face the challenge to implement these new tasks technologically, organisationally, and financially. At this point, the cooperation of GELSENWASSER shall be delineated using the example of CHEVAK Cheb in order to provide insights into the modernisation of urban water and wastewater treatment through public partnership in the Czech Republic.

Drinking water and wastewater are components of the cycle influenced by man and industry, which is integrated into the natural water cycle. As a private company with municipal background, GELSENWASSER offers concepts specifically designed for the local situation, which take into account the wishes and conditions of its partners. GELSENWASSER is especially suited for this task because drinking water also forms part of the company's main business. Around 230 mil. m^3 of water are provided for private households, public utility companies, and the industry annually. On the whole, 2.7 mil. citizens are supplied with drinking water. For 120 years, GELSENWASSER has been cooperating with municipalities in the area of water management. Accordingly, GELSENWASSER has substantial experience with municipal partnerships and offers a broad and demand-oriented range of products, services, and forms of cooperation. Successful GELSENWASSER cooperations in the privatised wastewater disposal sector work in Bremen, Dresden, Emmerich on the Rhine River, and Herne. An efficient and state-of-the-art disposal is guaranteed here – an accomplishment which the municipalities could have never achieved alone without drastically raising fees. The companies belonging to the GELSENWASSER group dispose of the wastewater of 2.2 mil. people. This technological, organisational, and financial experience helped GELSENWASSER to create ties with the city of Cheb and initiate a cooperation in form of a collective public utility company in 1994. This partnership was enlarged in 1998 when GELSENWASSER founded CHEVAK Cheb – the joint corporation for water supply and wastewater disposal – with communities in the service area in order to bring in the company's experience to the modernisation of urban infrastructure of water and wastewater treatment.

Figure 2. Model of cooperation



Source: CHEVAK Cheb.

3. Presentation of CHEVAK Cheb

CHEVAK Cheb is the key water supplier and wastewater disposer for the Cheb/Eger region located in the resort triangle of Karlovy Vary, Mariánské Lázně, and Františkovy Lázně. Correspondingly the biggest supplied communities in the region are the cities of Cheb, Mariánské Lázně, Aš, Františkovy Lázně, and others. In 1994, these communities contributed their water management assets to the joint company CHEVAK Cheb within the frame of a unified evaluation/ranking. This provided the basis for the company's transfer from a public enterprise to a private company.

Thus, today the company is equipped with the water management assets, on the one hand, and on the other hand, the involved responsibility for its stockholders (communities) and its customers. This business model was chosen to ensure the provision of services as well as the communities' influence in the company's different bodies. This is how CHEVAK Cheb successfully ensures water supply as well as wastewater disposal in the region.

Main indices on the services of the company are given in Table 2.

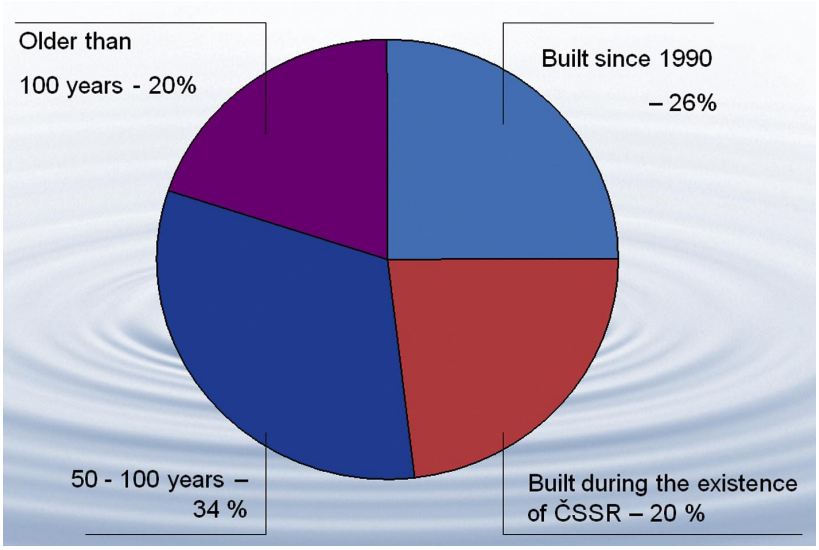
Table 2. Indices of CHEVAK

Sewage-work:	24
Sewerage network (km):	352
Sewerage connections:	8,401
Sewerage disposal (mil. m^3):	11,000
Drinking water network (km):	625
Water supply system connections:	11,584
Production of drinking water (mil. m^3):	5,500

Source: CHEVAK Cheb.

Since the service area is a rural region, the age structure of the water and wastewater systems looks as illustrated in Figure 3.

Figure 3. Age allotment of the system of pipes and hoses



Source: CHEVAK Cheb.

Due to the restructuring of the company and the limited investment activities of the past in connection to the higher demand for better drinking water quality as well as the quality of treated wastewater, GELSENWASSER AG set up the following main points for the overhaul of the infrastructure:

- technical and commercial cooperation to the benefit of CHEVAK,
- involvement of the needs of the population,
- assistance with investment schemes,
- regulation of water and wastewater prices within the framework of inflation, and
- outstanding quality of water to average prices.

4. The Tasks in the Czech Water Supply and Wastewater Treatment and Common Objectives of the CHEVAK Company in 1998

In order to guarantee a long-term trouble-free and standardised supply of drinking water and wastewater removal as well as to fulfil obligations resulting of the EU-accession process the Czech Republic had to enact several laws and to acquire obligations relating water supply and wastewater treatment. Among these, the Water Policy Guarantee and the Waste Water Policy Guarantee were especially important:

- **Water Policy Guarantee:** The compliance with the EU Directive 98/83/EEC on the quality of drinking water supply has been implemented in the Czech Republic by the Law on Public Health (Law No. 258/2000).
- **Waste Water Policy Guarantee:** The compliance with the EU Directive 91/271/EEC on environmental protection in connection with wastewater/sewage is ensured by an implementation directive, which is renewed annually by the Ministry of Agriculture.

In both areas, the Czech Laws No. 254/2001 on Water Budget and Management and the Law on Water Supply and Wastewater Treatment No. 274/2001 took effect subsequently.

4.1 Water Supply

For the area of Czech water supply the following tasks have to be fulfilled:
- use of charcoal and oxygenation in outdoor water treatment facilities,
- installation of corrosion protection in the pipeline network,
- exchange of forbidden materials and thus also exchange of the parts of water conduit,
- exchange of old plumbic service pipes/house connections, and
- removing acidity and radon in small water treatment plants.

Using more detailed data, the term “water” in this context means the following, among others:

Code	Unit	ČSN 75 7111	Directive 98/83/EEC and Law No. 258/2000
pH		6 - 8	6.5 – 9.5
Iron Fe	mg/l	0.3	0.2
Manganese Mn	mg/l	0.1	0.05
Nitrogen NO_2	mg/l	0.1	0.05

Additionally, from the microbiological viewpoint, "water" means the protection and control of non-occurrence of *Clostridium perfringens, Escherichia coli* and *Enterokokke*.

The central tasks of CHEVAK in the area of water supply and the measures to accomplish them have been defined as follows:

1. The drinking water quality has to be improved in the recycling process.
   - *recycling in the water treatment system*
   - *technical extension of the water treatment*
   - *modification and renewal of the raw water recovery facilities*

2. The water quality has to be improved in the distribution process.
   - *shutdown caused by the renewal of public water supply pipes*
   - *shutdown caused by the measures in the water treatment*

3. The water distribution network has to be enlarged to enable the shutdown of the pumping devices which are not able to meet the standardised requirements. Also, the density of the connections has to be increased.
   - *construction of new networks*

Fiure 4. Pump station CHEVAK Cheb – water-processing unit Nebanice

Source: CHEVAK Cheb

4.2 Wastewater treatment

By joining the EU on May 1, 2004, the Czech Republic incorporated both the existing EU guidelines as well as the directive No. 91/271/EEC about the cleaning of municipal sewage which stipulates to meet these requirements by the year 2010 at the latest. The general estimated investment volume in water and wastewater treatment to reach that obligation is about 118 bil. CZK (4.2 bil. EUR). The main part of the invested resources is directed to wastewater treatment (75 bil. CZK or 2.7 bil. EUR). The measurement focuses on the construction of wastewater treatment systems with facilities serving municipalities with 10.000 inhabitants in 2000 and the reduction of nitrogen and phosphorus in urban sewage treatment plants serving over 10.000 people.

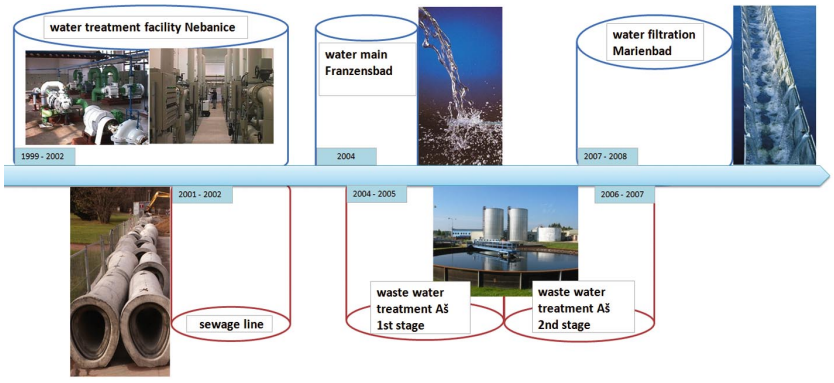
The central tasks of the GELSENWASSER AG and CHEVAK companies in the wastewater treatment area are the following:

- overhaul and renewal or enlargement of the wastewater treatment facilities in order to achieve the required influx values,
- enlargement of the wastewater treatment systems, and
- cleaning of wastewater in communities with less than 2,000 inhabitants, where sewers are installed.

All measures lead to meet the relevant laws of the Czech Republic and the EU Directive 2000/60/EEC (Water Framework Directive) which was passed on October 23, 2000, and established a framework for Community action in the field of water policy, whose goals have to be achieved within 15 years.

In the area of wastewater treatment, three wastewater treatment facilities (one being responsible for 25,000 inhabitants and two facilities for 5,000 inhabitants) and 22 km of sewerage pipes were overhauled by GELSENWASSER AG since the Czech Republic's accession to the EU.

Figure 5. Bulk investments of CHEVAK Cheb 1998-2008



Source: CHEVAK Cheb.

5. Example of Cooperation between the Companies GELSENWASSER AG and CHEVAK Cheb: Upgrade of the Water Treatment Facility Nebanice

As an example of cooperation between the companies GELSENWASSER AG and CHEVAK Cheb the upgrade of the water treatment facility Nebanice in the years 2998-2002 will be presented in the following. Initially, the drinking water treatment facility supplied 80,000 inhabitants and industrial plants with drinking water, which amounts to an annual delivery quota of 3.25 mil. m^3.

The quality of untreated water did not meet the required standards. Among others it contained a too high proportion of:

iron (Fe):	10 mg/l
manganese (Mn):	2 mg/l
and carbon dioxide (CO_2):	up to 300 mg/l.

During the original processing, the carbon dioxide was removed through aeration with an efficiency rate of 75 to 80% for the stabilisation of water and a subsequent chemical treatment for the removal of iron (0.18 mg/l EU limit 0.05 mg/l), manganese (0.1 mg/l EU limit 0,05 mg/l), and ph-terms.

The need for the improvement resulted from the following reasons:
- the replacement of obsolete technology,
- the improvement of aeration,
- compliance with the limits of iron and manganese in accordance with EU directives, and
- the saving of operating costs.

As an initial step, a starting concept was prepared with an investment volume of 13.4 mil. EUR provided by a traditional chemical water treatment facility.

Figure 6. Biological filtration plant water-processing unit Nebanice

Source: CHEVAK Cheb.

In cooperation between the GELSENWASSER AG and the CHEVAK companies, the needs and possibilities were newly evaluated and a concept modification was made. As the result, a biological water treatment was proposed, calculated with an investment volume of 8.1 mil. EUR. According to model tests serving to evaluate and to confirm the concept and the detailed planning and project work of the GELSENWASSER AG, the investment costs for the implementation could be cut to 4.6 mil. EUR. In addition, the operating costs were decreased by 20% compared with the old facility.

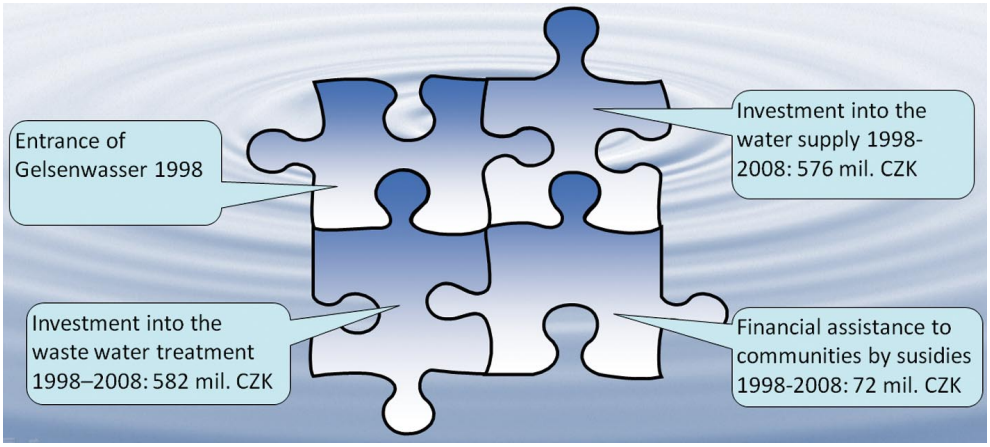
The project should not only be emphasised for having saved investment and operating costs. It is also the first time that biological water treatment has been established in this form in the Czech Republic, and it can now be displayed as a showpiece of a high empirical value to other Czech-based companies.

6. Results and Perspectives

6.1 First Results

The investment requirements for the years 1998 to 2008 were managed by the company in cooperation with GELSENWASSER in the total volume of 45 mil. EUR. This represents an average investment of 4.5 mil. CZK p.a., which could be reduced and subsidised by an average sum of 0.8 mil. EUR p.a. The investment volume of around 3.7 mil. EUR p.a. would not have been carried out by the depreciation on the basis of 1998 alone without a private involvement and contribution of the GELSENWASSER AG.

Figure 7. Cooperation of municipalities and CHEVAK Cheb in modernising municipal infrastructure in water and wastewater treatment



Source: CHEVAK Cheb.

6.2 Prospects

This should create the fundamental part for further operations in the period from 2010 to 2019. While doing this, main investments should flow into wastewater treatment. The most important projects are the overhaul and the repair of the sewage plants in Cheb and Mariánské Lázně as well as the connection of the city quarter called “Swedish Hill” to the wastewater purifying facility in Cheb. The investment volume is being planned to reach the amount of 50 mil. EUR, which are currently applied for in form of a promotion procedure in order to possibly reduce the total by 12 mil. EUR, which again corresponds with an investment of approximately 3.7 mil. EUR in average.

Hannes Aarma

Wastewater Modernisation Projects funded by the European Union in Estonia

Abstract:

In Estonia, the provision of water services and the modernisation of the water and wastewater infrastructure are determined by law. The realisation of both is the responsibility of the local authorities (incl. municipalities) of Estonia. However, as the country's Ministry of Environment is responsible for fulfilling international obligations and agreements, including the EU Accession Treaty and HELCOM rules, the Ministry has tried to coordinate the efforts of numerous (over 230) local authorities in up-grading the environmental infrastructure, mainly in the water and waste sectors. This has been achieved through the establishment of legal and administrative frameworks, financial support from the state budget, and the coordination of foreign grants to the environmental sector.
Keywords: municipal water and waste water treatment systems, waste water management, Estonia, European Funds

1. The Set-Up: Who Does What in Estonia?

As in all EU Member States there are a number of partners involved in programming, implementing, and evaluating Structural Funds intervention in Estonia, too. Overall management of EU-funded projects is the same in all sectors of the economy, including the environmental sector.

The key player is the Ministry of Finance (MOF) which is acting as the managing, paying/certifying, and auditing authority for all EU-funded programmes since 2000. The MOF has also coordinated all foreign assistance to Estonia, including grants from the EU PHARE fund and other assistance programmes after the restoration of the country's independence in 1991.

The Ministry of Environment (MOE) acts as an intermediate body (first level) for EU funds. It is responsible for aid programming, legal matters, including setting the rules for granting EU assistance, and supervision of the Environmental Investment Centre, which is also acting as an intermediate body, but at the lower (second) level.

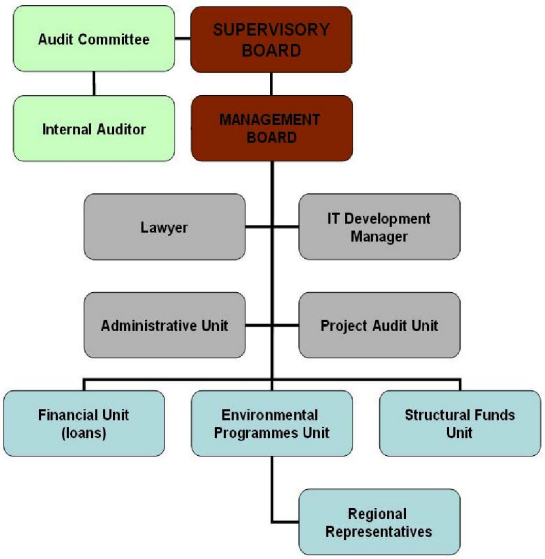
The Environmental Investment Centre (EIC) processes the applications and decides on EU funding. Moreover, it supervises the beneficiary's activities in making use of the grants and paying out EU funds. The EIC has been authorised to carry out these tasks by the relevant public management agreement between the Ministry of Environment and the EIC.

In making use of the EU funds the decisive role to play is for the Final Beneficiary (FB). In the water and waste management sectors, the FB is generally either a municipality or a company that is completely owned by a municipality or multiple municipalities. The Final Beneficiary is responsible for obtaining the results and reaching the objectives set for the projects supported by the EU. To this end, the Final Beneficiary procures all necessary works, services, and equipment (awards contracts after public procurement). In the majority of cases FIDIC conditions of contracts are in use (so-called "yellow, red, green and white books").

2. The Environmental Investment Centre of Estonia

The EIC is legal body acting under private law. It has been established by the Estonian government in May 2000 and it is administered by the Ministry of Finance. The EIC works on the basis of a statute confirmed by the Minister of Finance. At the end of 2009 it had 53 employees (cf. Fig. 1), a management board (2 persons), and a supervisory board (9 persons of which 2 have been appointed by the Minister of Environment, 2 by the Minister of Finance, and 4 by the parliament). The head of the council is the Minister of Environment.

Figure 1. The structure of the EIC



Source: Estonian Environmental Investment Centre.

The EIC conveys both Estonian and EU grants, mainly to the public and the third sector, such as non-governmental organisations. Since 2000, the EIC has been an implementing body for all environmental projects financed by the state budget as has been stipulated in the Law on Environmental Charges.

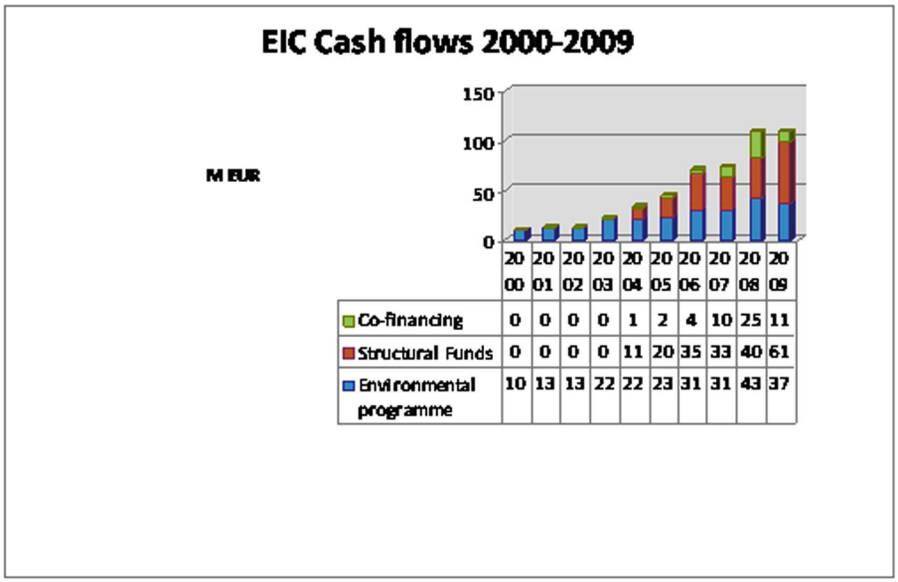
The EIC has also functioned as an intermediate body for EU grants since 2001. The EIC is an intermediary body for EU funds because it has developed a well-established management and control system (equipped with a manual of procedures, flow-charts, check-lists, forms of documents, etc). It also has experienced and competent employees who are responsible for CF/ERDF projects (10 well-experienced and 3 new employees) and benefits from an efficient personal network within the EIC itself and with external partners (Ministry of Environment, Ministry of Finance, local authorities). Periodically, the EIC carries out risk assessment(s) of its performance, which give input for project and system audits performed by internal and external auditors.

As an intermediate body, the EIC assists Final Beneficiaries in project application development, carries out ex-ante control of tender documents (compliance with public procurement law, eligibility of planned activities, and expenditures), and approves contract amendments and other contract's documents. Furthermore, it supervises the FB's activities related to project implementation, including the control of payment documents and on the spot checks, and enters information into the Structural Fund's database (including payment decisions). In addition to monitoring the financial and physical progress on the project and measure level, the EIC also provides the Ministry of Environment and the Ministry of Finance with monthly and annually payment forecasts, carries out audits (both on the project level and the management and control system level), and reports irregularities (if any) to the Ministry of Finance (Auditing Authority and Managing Authority).

Since its establishment in 2000, the funds channelled through the EIC have increased significantly (cf. Table 1). The incoming financial flows consist of:

- the assets transferred to the EIC upon its establishment,
- annual appropriations from the state budget (Act on the Environment Fees, § 59, OJ I 2005, 67, 512, passed on December 7, 2005),
- allocations from rural municipalities and city budgets,
- loans (taken by the government) for the EIC on-lending,
- special allocations of governments, other legal and natural persons of foreign countries, international organisations,
- grants,
- repayment of loans granted by the foundation and related interest receipts,
- funds received in the course of benefit events of the foundation, and
- other receivables.

Table 1. EIC cash flows from 2000 to 2009



Source: Estonian Environmental Investment Centre.

3. Environmental Projects Supported by Foreign Aid from 1991 to 2000

The approach for project selection and funding was "top-down," meaning that the Ministry of Environment addressed the donor countries, including the EU, with the assistance needs. The Ministry then decided which projects were the most important ones to be developed and funded. The weak point at that time was that the decision making was not based on water strategy documents like regional or river basin water management plans etc.

The main source of EU funding during that period was the PHARE programme and the multi-country programmes PEPA, INTERREG/CROSS-BORDER, and LIFE. The majority of funding for the environmental sector came from neighbouring countries Finland, Denmark, Sweden, and Germany (cf. Table 2).

Table 2. Overview of projects and funding

Sector	mil. EUR	Projects
Water and wastewater	10.0	60
Protection of water resources	25.0	34
Other (7) sectors	122.8	216

Source: Government Decree (Usage of Cohesion Fund support for the environmental sector in 1991-2000), April 5, 2004.

3.1 ISPA/Cohesion Fund environment projects in 2000-2006

13 water projects with total costs over 236.7 mil. EUR and 4 waste projects totalling 31.63 mil. EUR have been decided by the EU during the period 2000-2006 (cf. Table 3, costs given according to Financing Memoranda, Cohesion Fund + FB's co-financing, no additional costs added).

Table 3. ISPA/ Cohesion Fund 2000-2006 projects completed by 2010

	Costs (mil. EUR)	
	Total	from ISPA/CF
1-2. Tallinn waste management, I+II phases	4.2+11.1	3.1+8.3
3. Tartu water management (K2)	5.7	4.1
4-5. Narva WWTP reconstruction and Narva water management (sewage network rehabilitation)	8.8+9.5	4.9+5.2
6. Viljandi WWTP	6.3	4.7
7. Valga water management	7.0	5.2
8. Tartu water management (50km+50km)	19.3	13.5
9. Rapla water management	5.5	3.2
10. Pärnu waste management	7.4	4.6
11. Narva oil-shale waste management technical assistance projects (17)	7.1 7.1	5.2 5.3
Total	99.0	67.3

Source: Estonian Environmental Investment Centre.

Table 4. ISPA/ Cohesion Fund 2000-2006 ongoing investment projects

Investment project	Costs according to FM/EC decision (CF + local co-financing, in mil. EUR)
1. Kohtla-Järve water management	39.92
2. Lääne saarte water management	21.50
3. Matsalu-Haapsalu water management	27.57
4. Emajõe-Võhandu water management	53.69
5. Viimsi water management	13.10
6. Paide/Pärnu water management	19.84
Total	175.62

Source: Estonian Environmental Investment Centre.

Two different laws form the legal basis for water management in Estonia. The Act on Public Water and Sewage Systems stipulates that the development of infrastructures for water and wastewater systems is the responsibility of local authorities (§ 4). This Act also determined that local authorities have to approve the tariffs for water services. The obligation that local authorities are obliged to provide for public water and sewage services can be found in the Act on Local Authorities (§ 6, Article 1).

4. Water Management – after Accession to the EU

4.1 The Current State of Water Management (End 2009)

At the end of 2009, water management in Estonia is based on river basin plans (3 river basins covering 9 sub-district basins). Estonia has to meet the following (transition) deadlines:
For Articles 3-5 of the Urban Waste Water Directive, the country has to ensure wastewater collection in areas with more than 10,000 p.e. by the end of 2009. Until the end of 2010, wastewater collection in areas with more than 2,000 p.e. has to be provided.

The current state is that the infrastructure of wastewater systems has been (or will be) improved with EU-funded investment projects in 54 collection areas (out of the total 60 nationwide) with a pollution load of over 2,000 p.e. (5 from ISPA and local funding, 11 from Cohesion Fund 2004-2006 and 38 from Cohesion Fund 2008-2013). The Estonian wastewater infrastructure will be improved also in collection areas of less than 2,000 p.e., but no new infrastructure construction will take place (over 400 such wastewater collection areas have been defined by the Ministry of Environment).

The legal framework for financial support by the EU (2000-2013) is determined by:
- EU regulations and directives,
- National Strategic Reference Framework 2000-2006,
- National Strategic Reference Framework 2007-2013,
- Operational Programme for the Development of Living Environment 2007-2013 (and other OPs), and
- different Estonian acts:
  - Structural Assistance Act,
  - governmental (horizontal) decrees: conditions for payments, audit, publicity, eligibility,
  - ministerial (measure specific) decrees that establish the legal basis for projects implementation,
  - grant financing decision for a project (decided by the EIC).

The funds of the current financial period 2007-2013 are provided for the priority axis 1 of the Operational Programme, Measure 1.1. "Water and waste water infrastructure development," the total amount is 409 mil. EUR coming exclusively from the Cohesion Fund (ERDF= 0). Support is given for (net) revenue creating projects only. The Cohesion Fund's support must not be mistaken as state aid. In fact, the project owners have to finance amounts up to 70-75 mil. EUR (15% of the funding capital plus net revenues) without any additional financial support from the state. Finally, the funding has to be decided based on open call(s) for proposals.

4.2 Framework Conditions of Aid for Water Infrastructure Development

The Minister of Environment has decided that grants have to be used exclusively to enable the development of water infrastructure in the following areas and for specific measures as are:

- Wastewater collection areas over 2,000 p.e.: building and reconstruction of water infrastructure,
- Wastewater collection areas below 2,000 p.e.: reconstruction of wastewater systems,
- Wastewater plants over 10,000 p.e.: introduction of anaerobic technology.

Furthermore drinking water system reconstruction in over 50 habitants areas may be supported.

The Ministry of Environment has established the following eligibility criteria for applicants. An applicant must:

- be under local government (LG) or be a company owned 100% by LG,
- be financially sustainable,
- have evidenced own financing,
- have fulfilled tax obligations, and
- have valid applicable existing development plans for water and wastewater systems.

Furthermore existing water infrastructure must be owned by the applicant.

The requirements for an application are oriented towards EU standards, thus the application form is the same as proposed in EU 1083/2006 Annex XXI. There are mandatory annexes to an application as a *technical feasibility study* describing needs, goals, alternative solutions, basis for selection of a final solution, investment activities, well-founded budget, *an Environmental Impact Assessment (EIA) Screening*, *and a cost-benefit analysis*, which includes demand analysis, operational costs and revenues, investment budget, analysis of financial return on investment and on capital, analysis of financial sustainability, economic analysis, risk assessment, including sensitivity analysis, and an EU grant amount calculation.

The appraisal of water projects is carried out by experts approved by the EIC. To this end an expert panel (commission) is established that consists of water engineers, financial analysts, an environmental (EIA) specialist, and a lawyer. Each item or application document is assessed by different experts.

The engineers' tasks are to control and assess the applications with regard to their

- conformity with the existing legal framework, in first line EU directives and state policy requirements,
- water management and investment plans at the river basin level,
- water management development plan at the local government level,
- demand analysis, including housing schemes, industry development, migration trends,
- ownership of the infrastructure (existing and new), and
- main characteristics of the applicant water company, including organisational structure, ability to provide services, ability, and experience to carry out investment schemes.

The environmental specialist has to check the compliance with the EU Guidance on Environmental Impact Assessment and to control the respective screening published in June 2001. Required investigations are the scope of the project's possible impact on the environment and the duration of this impact. Impact assessment on NATURA 2000 sites has to be included as well as the probability of significant effects on the environment. In order to avoid significant effects on the environment preventative measures are described if necessary. Finally a so-called Competent Authority (local government or/and Environmental Board) has to arrive at a conclusion whether an Environmental Impact Assessment is needed or not.

If an Environmental Impact Assessment (EIA) is needed, the EIC's financing decision shall include specific conditions:

- The EIA has to be accomplished before making the first payment.
- If the EIA suggests changes based on selected alternative solutions for the project, any investment cost increase shall be borne by the applicant.
- An applicant may apply for a new decision to cover additional cost, if any unused budget is left.
- In case of a total change of the alternative solution a new application shall be submitted.

Financial considerations have to ensure compliance of the Feasibility Study with the European Commission's Community Based Approach to Local Development of the year 2008. They include: a baseline scenario, a full scenario, an incremental scenario based on a feasibility study, a demand analysis (consumer groups and numbers), service types (drinking water, wastewater), service volumes and production capacity, investment capacity (initial and replacement, eligible cost types, residual value), operating costs (eligibility of cost types, volumes, unit prices, rationale), and the operating income.

We have to prove further the consistency of the project with the Law on Drinking Water and Waste Water Systems and, especially, if the Polluter Pays Principle is observed.

For the Cost Benefit Analysis we use a unified general basis. The macro-economic data are provided by the Statistics Department of the Ministry of Finance, the reference period is 30 years. The mandatory benchmarks are the financial discount rate and the socio-economic discount rate. For the calculation we use current prices and the nominal discount rate. Only cash flows are considered. And of course the project owner must show an accurate EU grant calculation and, as stated earlier, evidence own financing with a legally binding confirmation.

With regard to loans, it is important to know that, the EIC has the right and capacity to on-lend EIB means up-to 100 mil. EUR total in order to facilitate the FB's own financing. Practically 95% of own financing is normally covered by borrowings. The estimated demand for loans is up to 130 mil. EUR. The loan applicants can be water project owners and financiers as are local governments and water companies owned 100% by local governments.

Loan applicants are required to give evidence about their creditworthiness. Their financial sustainability calculation must include all borrowing and loan payment activities including interest payments at a minimum rate of 6%. Collaterals as are mortgage, commercial pawn,

pawn of usage authorities must be placed. Local goverments have to obtain the permission for application from the Ministry of Finance.

4.3 Water Projects Decided in 2008-2009

As of 2008, the EIC has made 36 financing decisions during the first application round of water investment applications, the investments accumulating to an amount of 414 mil. EUR, including an EU grant of 306 mil. EUR.

Only three major projects (applying for 40% of the Cohesion Fund's total first round support) have been presented and approved. Every approved project meets the EU's eligibility criteria as checked in due course of appraisal. The second round of applications opened in August 2009 with a total budget for EU grants of 77 mil. EUR. Appraisal is currently under way and six financing decisions have been made as of 20 November 2009.

Approved projects have created benefits for over 20% of the Estonian population. For instance, drinking water systems have been upgraded for 268,000 consumers, from which 42,000 are new customers (establishment of new connections). As a result of seven projects, drinking water systems shall be reconstructed and good water quality secured. Also, wastewater collection and treatment for 247,000 consumers has been achieved, from which 41,000 consumers are newly served. Six wastewater treatment plants will be reconstructed and nine new ones will be built.

Investments are necessary to implement relevant EU directives. Additionally, those investments will affect both the surface and groundwater quality meaning a cleaner living environment.

Financial data about projects financed by the Cohesion Fund or other funds are stored in the Operational System of Structural Funds management (SFOS) whose owner is the Ministry of Finance. In accordance to SFOS data (as of October 23, 2009), payments shall be made on a yearly basis in the following amounts in EUR (cf. Table 5).

Table 5. Payments to be made by the Operational System of Structural Funds management

	Total	EU Grant	Own finance
2009	8 344 415.42	6 412 335.73	1 932 079.69
2010	147 149 202.81	111 360 361.75	35 788 841.06
2011	146 487 467.75	110 680 551.41	35 806 916.34
2012	63 653 909.80	45 803 680.24	17 850 229.56
2013	35 411 936.83	23 518 812.60	11 893 124.51
2014	12 971 186.08	8 503 882.60	4 467 303.49
	414 018 118.69	**306 279 624.33**	**107 738 494.65**

Source: Ministry of Finance.

When the EIC carries out EIB loan management (130 mil. EUR), the loan administrator analyses the loan application and prepares a creditworthiness analysis, in which all possible risks and risk mitigation measures are described. Then, the EIC's credit committee discusses the given analysis and decides whether to make a lending proposal to the EIC Board. The EIC Board later on makes a lending decision based on the proposal.

There are special loan characteristics for EIB loans: The minimum interest rates are for local governments: Euribor + 2%, for water companies: Euribor + 1,25%. The grace period is maximum 2 years after the project implementation period. The payment period is maximum 20 years and the repayment has to be made twice a year.

5. Problems and Lessons to be Learned for Further Project Management

During the previous financial period (2000-2006) projects were developed mainly applying the top-down principle. One result was that Final Beneficiary's performed weak ownership only. The selection of the projects was done by the Ministry of Environment who, together with the European Commission, finalised the decision, and the Final Beneficiary just had to transact it. A considerable structural and organisational problem consisted in the multi-level-management which included five different areas of responsibility: The Final Beneficiary, the Environmental Investment Centre, the Ministry of Environment, Ministry of Finance, and the European Commission. This complicated structure implied that there was no clear responsibility for results.

Important financial problems were caused by the "jumping" prices on the construction market. From 2006 to 2008 the prices escalated by 2.5 times which led to a considerable budget deficit. The deficit had to be covered by the state which was completed until 2008. New financial problems arise from the current recession. Caused by shrinking fiscal revenues there will not be state funding anymore.

Concluding from these experiences, in the current financial period (2007-2013) the EIC favours a bottom-up development of the projects. As the understanding of the application and implementation rules by the Final Beneficiaries is low, the development is mostly based on consulting expertise. As a side effect of the new procedure the start of projects was delayed, and there is the risk for loosing funds (see N+2/N+3rule in (EC) 1083/2006 Art 93). It cannot surprise that under the new conditions the Final Beneficiaries have difficulties to provide own funding. Especially municipalities have a very low borrowing capacity. A certain constraint consists in the poor construction market in Estonia which restrains cost-savings. A final challenge for the future is the improvement of the public procurement process which is still too slow and bears a lot of claims.

6. Conclusions

The experience of making use of EU funding for developing municipally-owned water infrastructure confirms that relevant investments are successful only if there is a strong ownership and commitment by the municipalities for the whole project cycle, i.e. the design, implementation, and maintenance of the infrastructure. To succeed the investments should be well justified, realistically assessed, balanced with the self-financing capacity, and professionally carried out.

The Estonian experience also shows that EU funding did not have a significant impact on encouraging local authorities to join efforts and creating bigger, e.g. regional or river-based water companies, which could provide cheaper water services in a more cost-efficient way. In the 2007-2013 EU programming period there is still a lot of development potential in this area, i.e. to select the right projects and implement them in the most appropriate way; or in other words: It is important not only to do the right things, but to do them right!

Krzysztof Filipek

Modernising the Water and Wastewater System in Bielsko-Biala

Abstract:

Since the early 1990s the Bielsko-Biala region has successfully modernised its water and wastewater system. In the beginning, organisational changes were introduced, including the ownership structure and IT system as well as technological improvements in the sewage treatment and water distribution system. Then, the long-term strategy has been successfully implemented, which comprised financial engineering, such as applications to European and world financial institutions, the preparation of a business plan with a long-term capital expenditure programme, internal re-engineering (Total Quality Management, ISO, Balanced Scorecard, outsourcing) and sustainable, innovative technical and technological solutions. As a result, kilometres of new sewage systems have been created and dozens of kilometres of drinking water network have been replaced. Moreover, wastewater treatment plants have been upgraded, which was accompanied by a large scale usage of biogas, the application of heat pumps, and environmentally friendly utilisation of sludge. Novel and effective methods of water quality improvement have also been applied.
Keywords: municipal water and waste water treatment systems, waste water management, institutional reforms, Poland

1. General Information about the Water and Wastewater System in the Bielsko-Biala Region

Bielsko-Biala is situated in the south of Poland, 30 km from the borders with the Czech Republic and Slovakia. It is located at the foot of the Beskidy Mountains. Its history goes back to the year 1312. During the centuries it has been under the control of various sovereigns and has thus become a melting pot of the Polish, German, Austrian, and Czech culture. Nowadays Bielsko-Biala has about 175,000 inhabitants. The Podbeskidzie region covers an area of 150 km^2 with Bielsko-Biala as its capital, and it has a population of some 300,000 inhabitants.

In the area of water and wastewater management the entire region is serviced now by AQUA S.A. The water company in the Bielsko-Biala region has a history of 115 years. Its foundation as a municipal enterprise is linked with the industrial growth of the community in the second half of the 19th century based on textile and textile machinery construction. During the communist rule the municipalities lost their ownership and the company was part of the central planned economy.

Figure 1. The Wapienica dam

Source: AQUA S.A.

AQUA S.A. was established in 1990 as the successor of the municipal enterprise responsible for water and wastewater services in the Bielsko-Biala region. It has at present around 38,000 water customers and more than 21,000 sewage customers. The company provides water and wastewater services using nearly 2,000 km of water mains and about 1,000 km of sewerage pipes. It takes water from 13 water intakes, including a mid-size water reservoir, the Wapienica dam (cf. Fig. 1) and the infiltration-type river bank intake at the Sola river (cf. Fig. 2). Wastewater is treated in two wastewater treatment plants: the big one Komorowice (cf. Fig. 3) and the smaller one Wapienica. Further information on AQUA S.A.'s water and wastewater assets is given in Table 1.

Figure 2. The Sola river

Source: AQUA S.A.

Table 1. Water and wastewater assets in AQUA S.A. (2009)

Water Assets	
Water intakes and their capacity	13 intakes of 148,000 m^3/day
Water mains	123 km
Water pipes, separation system	1240 km
Water connections	600 km
Water dam	Capacity of 1,000,000 m^3
Retention reservoirs	Capacity of 105,000 m^3
Wastewater Assets	
Sewerage system, combined	135 km
Sewerage system, sanitary	660 km
Sewerage system, individual connections	110 km
Sewerage system, rain water	72 km
Wastewater treatment plants	2 of 110,000 m^3/day

Source: AQUA S.A.

Figure 3. Wastewater treatment plant in Komorowice

Source: AQUA S.A.

2. The Water and Wastewater System in the Bielsko-Biala Region during the Transition Period: From the 1980s to the 1990s

At the beginning of the 1980, the situation of water supply was very complicated. The water had poor quality, the control system was not entirely created, and the standards were rather low and not comparable with average European standards. The level of services was also insufficient. Only about 60% of the population was connected to the sewerage system. Furthermore, the wastewater treatment plants did not meet modern standards as they did not have biological treatment. The mechanical treatment, which was partly supported by sedimentation tanks and chemical treatment, was the only technological achievement at that time. As a consequence, the wastewater discharge to the river was a main source of its contamination.

Another feature of the water supply during the communist period was that water services (like other services too) were nearly free of charge. Thus, the population had no consciousness that water supply and sewage cause substantial costs.

The political upheaval of 1989/1990 and the following political and economic liberalisation created essential and favourable conditions that, on the one hand, the basic needs of the

society could be better addressed and, on the other hand, the problem of environmental protection could be tackled at last. The transition from centralist politics to democracy and decentralisation involved also the return to local self-government as enacted in the Local Government Act of 8 March 1990. In this context the communities regained a number of rights including the definition of communal property. In the early 1990s, the Polish parliament decided to start a substantial privatisation process and to transform state-owned companies into private companies. This process also included the restitution of former municipal companies and assets into the ownership of the communities. Thus, in 1990 the city council of Bielsko-Biala regained the ownership of its water company.

Another political process with strong impacts on the water industry was the EU accession process. The Polish government applied very early for accession to the European Union. The accession process put ambitious targets in the field of environmental protection on the agenda, and thus higher standards of environmental protection were planned. Simultaneously, the EU accession process also provided communities and enterprises with the chance to apply for funding from various EU funds and international institutions.

Parallel to these institutional changes, new technical solutions for water and wastewater systems were introduced in Poland, beginning from IT solutions and supported by modern hardware and software systems.

After the formerly state-owned water company in Bielsko-Biala was transformed into the municipally-owned shareholder company AQUA S.A. in 1990, the company was restructured with some very clearly defined centres of business, and costs were attributed to corresponding areas of activity. In the middle of the 1990s, the management hired several European consulting firms which helped to introduce novel management tools and to be well prepared to absorb the different European funds. The management started cost-cutting attempts which led to the apparent improvement of the economic situation. On this ground, the company was able to apply for external funding and to receive, among others, a PHARE grant and a loan from the World Bank. The PHARE grant, 5 mil. PLN, was spent on the modernisation of the company's water dam. The World Bank loan, 12 mil. USD and 13.2 mil. DM, was spent on the following tasks:

- improving water supply safety, reliability, and quality of services,
- improving the efficiency of sewerage systems,
- reduction of contaminations discharged to the Biala river, and
- strengthening of the institutional abilities of the company.

During this phase, technical designs of wastewater treatment plants were elaborated and the construction project was successfully completed in 1997. New water treatment technologies, including high-rate filtration, contact coagulation and disinfection using liquid chlorine compounds**,** helped to meet required health standards. The quality of discharged wastewater, controlled by a regional environmental inspectorate, increasingly approached the new standards. Finally the number of customers who were connected to the sewerage system has risen from 60% in 1994 to more than 75% of the whole population in 1997.

As an EU candidate, Poland was obliged to meet European standards, including EU directives referring to environmental protection, the level of sanitation, as well as the quality of water and wastewater. Additionally, a new Act on the Collective Water Supply and Wastewater Treatment, a basic document for water companies issued in 2002, forced the companies to introduce some major changes in the way they were managed. Municipalities were obliged now to cover nearly all their occupation areas with the sewerage system. The quality of discharged wastewater was to be improved to meet high standards in relation to the biogenic substances. High investments had to be made, which effectively led to the improvement of the services, but unfortunately, also increased the costs and in this way the tariffs customers had to pay.

During these years, a real water market was created in Poland. Soon the enterprises had to realise that with growing costs, the economic barriers grew as well. A brand new problem arose for the whole water sector: The companies had to realise and to learn that the regulating role of the city councils was crucial. They were responsible for approving tariffs and the applications for EU funds prepared by the water companies. They were thus the highest local authority to decide whether the company was to construct new kilometres of sewerage systems, upgrade the plants, and improve the level of services or not.

3. From a Municipally-Owned Shareholder Company to a Public Private Partnership

According to the Local Government Act, the communities have had the right to privatise communal property since 1990. In 1999, AQUA S.A was partly privatised by means of selling its shares on the open market. Since then the city of Bielsko-Biala and the British company United Utilities are the main shareholders (cf. Table 2). While a number of Polish cities sold communal assets or whole enterprises, this was not the case in the area of water and wastewater management. Thus the city of Bielsko-Biala and AQUA S.A. have been trailblazers.

Table 2. The shareholders of AQUA S.A.

Shareholder	Number of shares (%)
The city of Bielsko-Biala	51
United Utilities (Poland) BV	33
The collective shareholders (cities, housing communities)	12
The individual shareholders	4

Source: AQUA S.A.

The history of AQUA S.A's privatisation began with some detailed discussions of the city mayor and the management board of the company with representatives of the World Bank. The municipal authorities were convinced that the privatisation could help the company to enhance its management and also to improve its economic condition. The consulting companies COWI and SAFEGE were charged with elaborating technical and organisational studies as part of an Information Memorandum which formed the basis of the privatisation

negotiations. The local authorities, including the mayor and the president of the city council, were a driving force in the whole process. According to the public procurement procedure, an advertisement about privatisation was publically announced. Several big, international water companies expressed their interest and finally, two companies, German Gelsenwasser and British International Water/United Utilities, were on the short list. The share price was the primary criterion. Nevertheless, know-how transfer, a cooperation agreement to determine a payback period, dividend attribution, a number of supervisory board members, and details of the proposed articles of association were also taken into account.

The British proposal was estimated to be the best one, and International Water/United Utilities Holding BV became a shareholder of AQUA S.A. The final decision of the tender committee was then approved by the city council. After that, the State Antimonopoly Office gave its "no objection" to the transaction. Thus, some 23% of the shares were sold to IW/UU Holding BV. After one and a half years the investor purchased about 11% of additional shares by means of the Warsaw Stock Exchange transaction.

According to the long-term cooperation agreement, the investor has been authorised to take his dividend and also 50% of the dividend attributed to the city until the investor achieved the assumed rate of return. The know-how transfer was also paid for by the company. All the rights and responsibilities of the parties were described in the mentioned cooperation agreement.

As a shareholding company AQUA S.A. is listed in the Warsaw Stock Exchange, at the so-called "secondary market" (CeTO). Some basic economic data of the company are given in Table 3.

Table 3. Basic economic data of AQUA S.A

Basic economic indicators	Value of indicator
Total assets	Euro 110 million
Equity	Euro 75 million
Annual revenues	Euro 25 million
Water tariff	Euro 0.9/m^3
Wastewater tariff	Euro 0.85/ m^3
Fixed fees	depending on water meter size
Rain water tariff	As wastewater, depending on the flow area

Source: AQUA S.A.

To meet all the specific interests of the different shareholders AQUA S.A. has to compromise in all areas of its activity. The company's annual budget and capital expenditure programmes are presented under the supervision of the shareholders and are approved by the city council. For every new year tariff proposals have to be submitted at least 70 days before the end of the previous year. Then, these 70 days are used for discussions with the city council. The fees are based on carefully justified costs including a few percent of profit. The resulting charges for water, sewage, and fixed fees are then compared with the disposable income of an average

family (the expenditures for water and sewage services cannot exceed about 4% of that income). If problems arise and the company assumes that fees may not be approved, necessary cost-savings or additional sources of income are considered. Fortunately, in the last 7 years the proposed fees have always been approved.

4. A New Management Strategy of the Company

As a consequence of, on the one hand, the new ownership structure, and on the other hand, the new requirements of the water sector, AQUA S.A. prepared and implemented a new strategy, including a new cooperation agreement between the shareholders that was oriented towards the company's needs and its development. During the first years the company's capital expenditure programme had to be adjusted to its limited financial resources, for in that time (the years of 2003-2004) it was not possible to apply for EU funds or to obtain other external sources. Nevertheless, all environmental and formal requirements had to be met.

The company's present construction programme is a result of intensive discussions with the customers, and their specific needs have been included into the programme. Every individual project is based on economic analysis, and Net Present Value is the basis of cash flow planning. Our revenues come from our customers. The annual business plan, including expected costs, expenditures, and revenues (i.e. fees) is subject to city council approval. If the company's budget cannot meet the necessary costs, then, the external sources of financing (loans, credits, grants from EU for the period 2007-2013) are taken into account. Thus, the financial engineering is also a matter of the city council consideration. Once the annual fees are approved, the company is ready not only to cover all the "technical" costs but also all the financial costs of loan/credit repayment.

To reach these formal standards and to properly manage the company, a long-term business plan had to be elaborated. The main tool of the new strategy was the implementation of the ISO standards. To create a target-aimed road map for the company's activities, the work was divided into a few core business goals and respective detailed tasks. The company successfully implemented management standards according to ISO 9001, 14001, 22000 (previously HACCP), and 17025 for its laboratory. The ISO processes were linked to the corresponding business plan and Balanced Scorecard goals.

Table 4. Main goals of Business Plan and the ISO processes of the management system

Business Plan goals	ISO processes
Strategic indicators and operational goals	Strategic management
Financial goals	Finances
Water and sewage quality	Controlling and examination systems
Assets management	Repairs, watermeters, GIS, IT systems
Business development	Procurement
Quality of services, health& safety, environmental protection, HR	Service preparation, water and sewage sales food safety, human resources management

Source: AQUA S.A.

Furthermore, new management methods have been introduced. In selected key business areas, key performance indicators were set up, which had to be achieved by the whole company and its individual departments. Thus, financial resources security, improvement of the relationships between the company and its shareholders and stakeholders, and good quality management provided the basic background for the success. The management elaborated a four-perspective Balanced Scorecard to optimise the company's output. The four perspectives which are considered are:

- customers,
- environment,
- shareholders, and
- internal effectiveness.

Since better quality of services is crucial for *customers*, AQUA S.A. decided to shorten its reaction times to customer complaints. Some new repairs and replacement standards were introduced. Dozens of kilometres of new sewerage system were constructed to connect more and more people to the system. New filtration and disinfection systems have also been constructed in order to upgrade the quality of water, including the application of UV light and movable Cl treatment units, supported by application of anticorrosion agents.

To improve the commitment to the *environment* AQUA S.A. succeeded in upgrading its wastewater treatment plant using a very modern dynamic step feed technology to effectively remove organic and biogenic substances and to discharge treated sewage of required quality. Additionally, the company constructed a heating system to use biogas that is produced from the sludge, which is a by-product of the sewage treatment process. Moreover, heat pumps have been successfully applied to provide heat to the company's buildings. The inflow wastewater was a source of energy. As a result, AQUA S.A. has been recognised as a leader in applying renewable energy. For instance, the company was awarded the prize for Leader of the Polish Ecology by the Ministry of Environment. And recently, the Polish committee of the European Business Awards for the Environment, handed out by the European Commission, selected the company to present its achievements in Brussels in June 2010.

Shareholders are interested in keeping the company at a high economic level in order to get maximum revenues. The strategy of cost cutting has led AQUA S.A. to a very safe economic position. All basic processes (formal and technological) undergo a strict controlling system. The profits are distributed taking into account the needs of the company and the shareholders' requirements as well. The company's assets construction strategy is based on the Net Present Value of the shareholders. The capital expenditure programme is strictly based on the idea of weighted average cost of capital.

In order to improve *internal effectiveness* AQUA S.A. introduced several important organisational changes to focus on the customer-sensitive and cost-effective areas. The company is a leader in active leakage control in order to keep non-revenue water at the lowest, economically justifiable level. A separate department responsible for the detection of illegal customers and on-line control of industrial customers was created as well as a bonus system which is based on effectiveness indicators to show for instance additional revenues,

reduced costs, and new customers. Every department has its own Key Performance Indicators (KPI) to be determined every month and revised every three months. The results are then taken into account in the bonus calculation for every head of department and, consequently, for every employee.

5. How to Successfully Modernise a Municipal Water and Wastewater Company?

There is no question about the very successful modernisation of the water and wastewater system in Bielsko-Biala by the company AQUA S.A. since the beginning of the 1990s. What were the main premises and action steps up to that point?

Firstly AQUA S.A. had good preconditions: The company has a tradition of more than 100 years, and it started its transformation process as a well-organised and well-managed company. Secondly, the municipal authorities were convinced that privatisation could bring long-term positive effects. Decisive steps of the company's management were:

- to analyse the organisation and make improvements, which were possible without substantial investment,
- to set up a financial model and a business plan,
- to establish good contacts to the city administration and council and to spread information about the company, its services, and needs,
- to implement new management systems, as there are ISO, Balanced Scorecard, KPIs,
- to define financial resources and to consider different types of financing, including funding and private investment,
- to propose a partial privatisation of the company and to introduce the proposal to the city administration and council,
- to invite tenders and to meticulously verify the quotations, and
- to prepare and to bargain a treaty which defined the aims and the strategy of the new company as well as the interests of the different owners.

4 EXCURSUS: MUNICIPAL INFRASTRUCTURE IN THE RUSSIAN FEDERATION

Ruslan Sadyrtdinov

Modernising Municipal Water and Wastewater Treatment Systems: The Case of the Russian Federation

Abstract:

The paper studies the modernisation of municipal water and wastewater treatment systems in modern Russia. The author reveals key factors that influence the poor conditions of the Russian water sector, such as inadequate management systems, the dominance of political expediency over economic considerations in the area of tariff regulation, the unsatisfactory financial situation, high costs, the lack of economic incentives to cut the costs related to the provision of public services, the underdevelopment of a competitive environment resulting in the poor performance of businesses, as well as massive losses of power, water, and other resources. Special attention is paid to the possibilities of increasing the effectiveness of municipal management in water and wastewater treatment by using the instruments of public-private partnership.
Keywords: municipal water and wastewater treatment systems, waste water management, institutional reforms, Russia

1. Introduction

In our lives, water is of vital importance because it is simply not possible to exist without it. Moreover, it is used not only for drinking and household purposes, but also as a means of developing industries and agriculture. Nevertheless, experts all over the world argue that a shortage of fresh water will be one of humankind's greatest problems in the near future. They even warn that major conflicts will be waged over water. The nascent water crisis has two key causes: a diminishing of headwaters and ground waters and the pollution of water sources. These interrelated trends are a result of poor use of water and obsolete discharge facilities. Therefore, the development of water supply and wastewater disposal systems is part and parcel of the growth of civilisation. The quantity of water consumed by man determines the degree of social development in a society.

Russia possesses one third of the planet's water resources – second only to Brazil and Canada. Lake Baikal in southern Siberia is the world's largest freshwater lake and contains 20% of global freshwater and 80% of Russia's freshwater. The country contains five major drainage basins, Europe's longest river, and 10 mil. km^2 of permafrost, but they are distributed unevenly across the country. The industrialised regions of European Russia, where as much as 80% of the population lives, only have 8% of the annual volume of river headwaters. At the same time, the housing and utilities systems which were built in the cities during the Soviet period, have become obsolete and are giving way, with pipes bursting, holes appearing in the soil,

houses undercut by ground waters, and problems with water quality in the summer. Local authorities cannot solve these problems without assistance, and the housing and utilities sector badly needs reform and investment. This study attempts to unveil the reasons that cause the failure of municipal water and wastewater treatment systems in modern Russia, and it seeks to analyse the process of modernising these municipal systems in order to reveal and advance the best practices (Yashechkin, Svetlitsky 2008).

This paper is organised in six parts. To provide a background for this study, the following section will look more closely at the situation of municipal water and wastewater treatment systems in post-reform Russia. The third section introduces the key factors influencing municipal water and wastewater treatment systems in modern Russia. The process of modernising municipal water and wastewater infrastructure in Russia is then analysed in the fourth section. The fifth chapter addresses the modernisation of water and wastewater systems in the city of Kazan. In the sixth section, the new federal programme "Clean Water" is assessed and conclusions are presented in the final section.

2. The Situation of Municipal Water and Waste Water Treatment Systems in Post-Reform Russia

The history of water supply systems in Russia spans many centuries, but the development of wastewater disposal (sewerage) systems in Russia has significantly lagged behind that of water supply systems. When towns gradually started to develop central water supply by using water mains in the second half of the 19th century, central wastewater disposal was not yet an issue. The removal of sewage from houses was arranged by a cesspool set up in the yard with the subsequent transportation to dumps. At that time, these dumps were set up at a distance of merely 0.5-2 km from residential areas.

According to figures from the Ministry of Natural Resources and Ecology of the Russian Federation, the services of centralised water supply and centralised sewerage are nowadays available to 99% and 97% of the population in towns respectively, in settlements to 93% and 74%, and in rural areas to no more than 29% and 4% of the population. The country has a total of 8,801 water supply systems, with centralised water supply used by 106.5 mil. people resident in 1,092 towns and 1,872 urban-type settlements. The total length of water mains in Russia's population centres is 463,000 km, including 200,900 km in towns (43%). The capacity of water supply systems is estimated at 90.0 mil. m^3/day with towns accounting for about 71.0 mil. m^3/day (79%) (FSSS, 2010).

By law, all newly built houses or enterprises have to be connected to a sewage system. Since most towns are equipped with centralised sewage networks, the implementation of this obligation is not a problem. Villages mostly do not have networks, so the people discharge their greywater into the nature and the black water into pits. Industrial and agricultural enterprises are legally obliged to have pre-treatment facilities before discharging into municipal sewage networks or into surface waters. The operation and efficiency of such pre-treatment facilities always depends on the financial capacities of the enterprise.

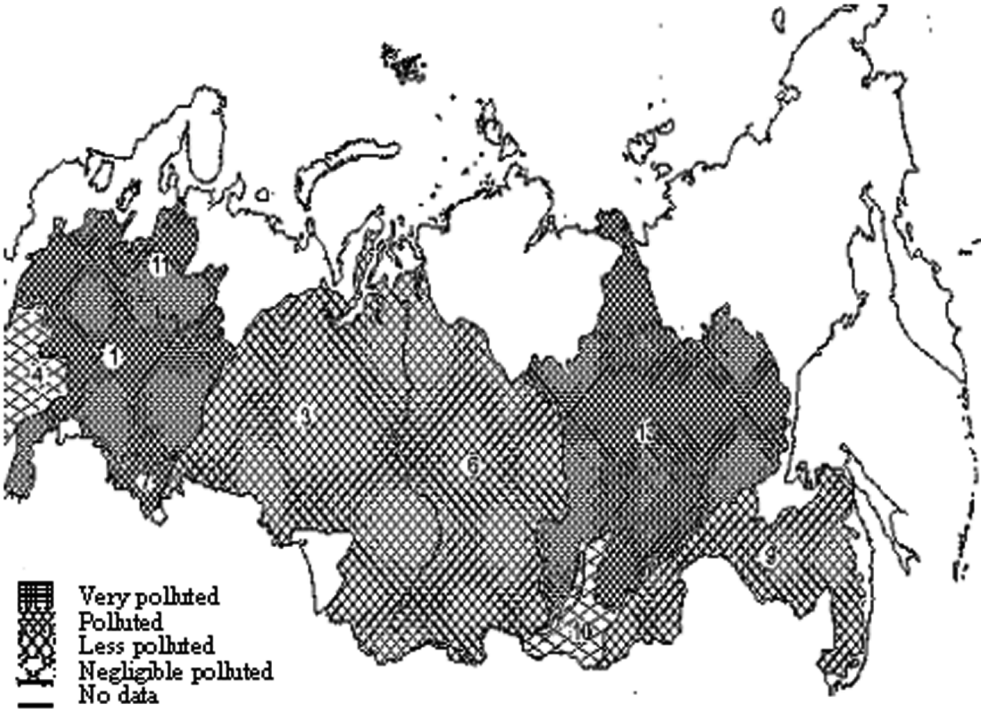
At the end of the 20th century the development of the public water supply and sewerage systems in the settlements faced problems, which were growing and, eventually, led to the crisis of 1990s. Despite the growth of the urban population, there were no adequate investments in the development and upkeeping of water supply and sewerage systems for decades, which led to an acute misbalance between the demand for water and the actual systems' capacity. Most of the systems had been in operation for more than 20 years, some facilities had even been operated for more than 50 years. The rate of repairs, replacement, and restoration works lagged far behind the rate of systems decay; the breakdown rate was much higher than average (more than half of the systems network was accident-prone), which led to constant interruptions of water supply. However, the quality of the water in the systems was generally up to the norm; there were periods when the water quality index was on the brink of acceptability (that concerns the iron and residual ammonia content, oxidisability, turbidity, etc.).

Despite all these efforts, the overall water quality of freshwaters has only improved little during the 1990s. Nevertheless, the discharge of wastewater into water bodies was reduced by approximately 30%, from 76.4 to 55.7 m^3/year. The amount of polluting substances in wastewater also decreased, for several parameters even up to 50%. According to the State Water Inventory, substances that most often exceed the maximum allowable concentrations in discharged wastewater are:

- nitrate-ammonium (N-NH4) in the basins of the rivers Volga, Terek, Amur, Western Dvina, and Lake Baikal,
- copper in the basins of the rivers Ob, Kuban, and Neva,
- phenols in the river basins of Yenissei and Western Dvina,
- phosphor in the basins of the river Don, Ural, and Dnieper, and
- oil products, organic substances, nitrite, iron, zinc, and manganese in the rivers mentioned above (UNEP, 2000).

In 1998, the most polluted river basins were those of the rivers Neva and Western Dvina, followed by the Volga, the Northern Dvina, and the Lena river (cf. Fig. 1). Not included in these statistics are estimates about non-point sources of pollution, such as the impact of agricultural activities on water quality, urban run-off, transport and others. Furthermore, no accidental water pollution or diffuse irrigation water is included in the given statistics. In 1998, the amount of water used for irrigation was 7.3 m^3, of which more than 50% were used in the river basins of Kuban, Terek, and Don. A large part of this irrigation water is polluted by toxic chemicals as well as nitrogen and phosphor from fertilisers. The exclusion of the polluted irrigation water from statistics leads to a distortion of the amount of discharged polluted waste water in the mentioned river basins.

Figure 1. Pollution degree of the 14 main river basins in the Russian Federation (1998)



Source: Zhmur (1999).

Insufficient or untreated wastewater is a serious source of pollution for natural water bodies. According to data from the State Water Inventory, 22 km^3 of such wastewater (12.3% of all discharged wastewater) was discharged into surface water in 1998. Another source of pollution is the diffuse input of polluted water from settlements without sewage networks, from streets and related traffic, from sealed surfaces in enterprises, and from agricultural areas. Diffuse sources of pollution generally contribute more than 50% to the total pollution of water bodies. More specifically, the share of various substances is as follows: 60-80% nitrogen, up to 80% pesticides, 70% oil products, 80% suspended matters, and 20% organic substances. A third source of pollution is sewage sludge that is produced by wastewater treatment plants. In Russia, the annual mean amount of sludge production is about 80 mil. m^3 (with a humidity of 96-97%), which equals an amount of dry substance of about 3 mil. tons/year (Zhmur, 1999). Reuse, composting, or incineration of sludge is not common. The sludge contains a high amount of metals and other hazardous substances, which is why its treatment becomes very expensive. Almost all sludge from treatment plants remains untreated and is disposed off on sludge fields. Due to the country's size, there is enough space for new sludge fields. According to the law, closed or used sludge fields have to be monitored regularly which is, however, not always done under the present economic conditions. During rainfall and snow melt, the sludge may be washed away and can adversely impact previously unpolluted areas.

To solve these problems the Russian government approved the three-stage sub-programme "Reform and reconstruction of the municipal housing economy of the Russian Federation" in Decree 797 on November 17, 2001. The reforms envisioned by the federal government aim at implementating measures that promote the attractiveness of the water supply and wastewater systems to private investors and foster their participation in stimulating the sector's reconstruction and development. However, in spite of all this, the condition of Russia's utilities, and in particular of the water and sewage utilities, is still considered critical nowadays. According to figures from the Federal Agency for Construction, Housing and Utilities, the degree of wear and tear on public utility infrastructure facilities in certain municipal entities is as high as 70-80%, with the degree of wear and tear increasing by 2-3% annually. In the sector of water and sewage utilities, the wear and tear on property, plant, and equipment ranges from 50 to 70%. Specifically, the wear and tear of water mains is 65.3%, of sewerage networks 62.5%, of water-supply pumping stations 65.1%, of sewerage pumping stations 57.1%, of water purification facilities 53.9%, and of sewage treatment facilities 56.2% (FSSS, 2010).

A situation like this has many reasons: Next to inadequate management systems, the dominance of political expediency over economic considerations in the area of tariff regulation, the unsatisfactory financial situation, high costs, and a lack of economic incentives to cut the costs related to the provision of public services, other reasons include the underdevelopment of a competitive environment which results in the poor performance of businesses and massive losses of power, water, and other resources. These key factors will be analysed in the next section.

3. The Key Factors Influencing Municipal Water and WasteWater Treatment Systems in Modern Russia

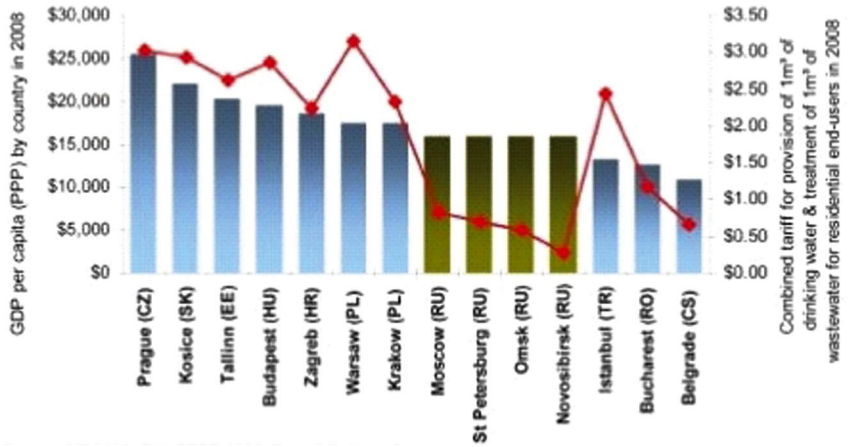
The overwhelming majority (over 90 %) of water supply and wastewater disposal operators, known in Russia as "Vodokanal," are municipal or state unitary enterprises. The relationships between state or municipal administrations and their Vodokanals are in most cases not clearly defined. Some types of service agreements exist between administrations and Vodokanals, but most administrations do not use them in practice and fulfil regulatory functions in a non-systematic way. The chief (general director) of the Vodokanal is appointed by the local administration – the owner of organisation – and often in an untransparent manner. As a result, the local population and other stakeholders inevitably receive less attention from the general director than the local authority. The incomes of Vodokanals depend on an annual procedure of local budget approval, which is why the attitude of the Vodokanal towards financial planning is reminiscent of a non-commercial, state-financed organisation despite the fact that it is a profit-making organisation by law. Also, Vodokanals often do not work directly with their residential users because payment collection is undertaken by the municipal service division which acts as an intermediary. Consequently, the concepts and principles of corporate management in terms of protecting shareholders' rights are irrelevant for municipal enterprises as are Vodokanals.

The level of competencies achieved by managers and employees of municipal administrations and enterprises is usually not sufficient to enable them to accept strategic solutions for the development of water and wastewater systems. On the one hand, some Vodokanal managers do not have the motivation to raise the level of their own training, and on the other hand, there are not many educational institutions in Russia with refreshing courses for water and wastewater management.

At the beginning of the economic reforms in the early 1990s, it was believed that a transition to the unsubsidised operation of utilities would be completed within a sufficiently short period of time; the socio-economic situation, however, made it impossible to complete the transition. And by the beginning of the 2000s, the public paid about 60% of the cost of utility services, which actually meant about 40%, with exemptions and allowances factored in. This problem still exists today: Vodokanals do not receive full repayment for the services they provide.

Water tariffs traditionally constitute a major source of revenue for municipal enterprises. The fact that such tariffs are very low in Russia and are also substantially below the level of most other countries of the Central and Eastern European (CEE) region, highlights a major money crunch. Figure 2 illustrates the comparison of tariffs in key cities of the CEE region to GDP per capita at a country level. Tariffs in Moscow, the most affluent city in Russia, are 30% lower than the tariffs in Bucharest, nearly three times lower than in Istanbul, and more than 3.5 times lower than in Warsaw or Prague. Moreover, the water tariffs in Moscow rank first among Russian cities as prices in the remaining cities, such as St. Petersburg, Omsk, or Novosibirsk are much lower. In certain places, the tariffs are 3 times lower, for example in the city of Novosibirsk.

Figure 2. Comparison of combined tariffs for water supply and wastewater services in CEE region metropoles (relative to GDP at a country level, 2008)



Source: IMF 2008, GWVOECD 2008, Frost & Sullivan Analysis.

Water tariffs in Russia have increased only slightly since the early 1990s. It is worth mentioning that bills for water supply and sewerage disposal services are rarely based on measured consumption: Thus, unlike countries in the CEE region, the level of water consumption in Russian households has remained invariably high over the last years, translating to substantially higher energy and operational costs for water utilities. Revenues generated by them on water bills are typically insufficient to cover not only the critical capital investments but also operational expenditures (OPEX). As a result, Vodokanals require financial endorsements both for their daily operations as well as investments in infrastructure rehabilitation and expansion.

There is a tariff cross-subsidy for one group of consumers (local population) from other groups (mainly, profit-making organisations). This cross-subsidy is gradually being stopped, but with socio-economic reasons guiding the situation, industrial consumers in many places still face higher tariffs to protect the general population. All this prevented economic growth, increased profitable companies' expenses, and made social and ecological problems even more acute.

Municipal administrations also have to pay additional money to maintain water facilities. This is the other side of the coin of low tariffs in Russia. Due to these low tariffs, water consumption in big cities is relatively high. This in turn leads to municipal enterprises having 2-3 times more OPEX. Combining low tariffs with high OPEX leaves Vodokanals with limited resources for capital expenditure. The tariff policy in Russia has always been dominated by political reasoning and has superseded economic requirements. Increasing tariffs are likely to require actions to be taken at the federal level, which is a very difficult goal to achieve during an economic recession.

The continuing budget allocations for housing and public utilities in turn, led to a dramatic increase in the wear and tear of the capital assets at the local level due to a shortage of funds. The situation deteriorated particularly in the territories that received financial assistance.

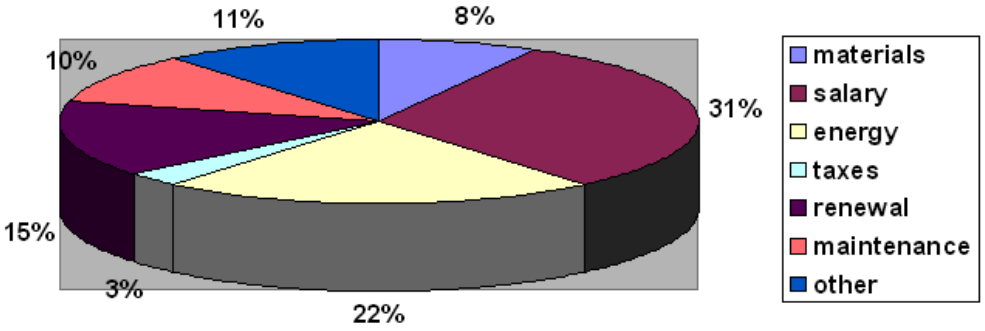
In the beginning of the 2000s the shortfall in funding for the housing and utility sector was more than 20% of the funds needed. The problem is aggravated even more by the enormous amount of arrears in housing and utilities, foremost due to the treasuries' failure to honour their commitments. The arrears triggered a chain reaction of payment defaults, which has extended to cover virtually all economic sectors.

However, in 2005, there was a substantial increase in utility tariffs, after which the scheme of regulation for the period until 2009 has been substantially changed. These changes included the establishment of a three-stage order of tariff approval. Prices are now considered at the municipal level first before their claims are assessed by the individual state, and final approval takes place at the federal level, the Federal Service for Tariffs.

The annual determination of tariffs is undertaken on the basis of an "own costs plus a set limit of profitability" (cost plus) method, and Figure 3 illustrates what is included in the tariff. Thus, the current rates are indexed to the rates last year. This situation creates the risk

that the operator is deprived of any motivation to reduce costs: Why lower the costs of services, if this year's savings will be removed from the tariffs in the future? A cycle of one year is too short to accumulate any funds for investment financing (Ivanov and Sivayev, 2007).

Figure 3. Components of water utility tariff



Source: Ivanov and Sivayev (2007).

Despite the fact that funds for renewal are included in the tariff calculation, there is no clear reconciliation procedure between the local authority and the Vodokanal in terms of the amount of these funds and the procedure for controlling expenses against planned values. This means that no objective criteria are designed to justify the expenditure needed by the Vodokanal to undertake a complete renewal. This is the reason why the Vodokanal's suggested expenditure for renewal is usually reduced considerably during the tariff review. The Vodokanal's expenses, which are not included in the net cost of services when calculating tariffs, are assumed to be covered by deducting depreciation funds and income. But income (if any received) is used to cover the difference between the amounts owed under outstanding invoices and the payments received.

The scarcity of available funding for investments over the past 20 years and the insufficient financing available for renewals and the technical maintenance led to the bad technical situation of water and wastewater systems. In addition to a high level of wear and tear, the technical condition of the public utility infrastructure in Russia is characterised by a high accident rate, low efficiency of capacity utilisation, and high losses of energy products. Scheduled preventive maintenance has given place to emergency-response and accident-recovery work, the cost of which is 2-3 times higher. This has exacerbated the problem of the drinking water supply of the Russian population, the shortage of capacities for water conditioning, and purification and wastewater treatment.

One of the causes of the present situation is that municipal utilities have little or no economic incentives to streamline the cost structure and cut down on the inefficient use of material. As a result, the consumption of electric power for the production and marketing of 1 km^3 of water is 30% higher than the European average, the number of personnel per 1,000 residents

serviced is 1.5-2 times higher than at similar European businesses, and the consumption of water per resident is 1.5-2 times higher than in West European countries.

A review of the majority of investment projects that have been proposed by municipal authorities to improve the public service systems shows that they are mostly designed to extend the capacities with far fewer measures contemplated for the reduction of costs, losses, and leakage.

The failure to provide budgetary allocations and the lack of effective and transparent procedures for setting and changing tariffs make the housing and public utilities sector unattractive for private investment. On the other hand, a majority of public utility infrastructure modernisation projects are potentially attractive commercially. Modernising the sector and guaranteeing favourable conditions for the inflow of private investment may fuel a dramatic change in the technological and financial situation of the sector.

4. The Process of Modernising Municipal Water and WasteWater Infrastructure in Russia

The reform of the housing and public utilities sector has been in progress for more than 10 years now. The Russian government first focused its efforts on the problems of the public-service sector in 1997, when the Presidential Decree "On the Reform of the Housing and Utilities Sector in the Russian Federation" was passed. That started the development of the formerly monopoly-dominated sector towards entrusting the public utility infrastructure to the most effective managers, towards healthy competition, but with public controls kept in place. The main obstacles to the implementation of the programme were the utilities' multi-billion arrears in payable and receivable accounts, the shortage of resources, and the lack of effective mechanisms to drive the reform.

The reform of the sector of water supply and wastewater disposal envisaged the implementation of the following measures that aim at promoting the attractiveness of these systems to private investors and fostering their participation to stimulate the sector's reconstruction and development:

- reconstructing the infrastructure,
- reducing misallocations of personnel, energy, and water by Vodokanals,
- increasing the economic independence of the enterprises and their responsibility for the quality of customer service,
- ensuring an optimal balance between the economic independence of Vodokanals and state regulation of their activities, taking into consideration their monopolistic nature, the requirements for their development, and the need for more powerful protection of consumer interests, and
- stimulating an optimal economic development of the fixed assets and investments belonging to the Vodokanals by ending unnecessary investments, and the creation of fixed assets with excess capacity, perfecting water supply management, and producing a reliable service.

To implement the reform, the federal government had to determine police directions, create a coordinated legislative foundation to support the reform programme, determine control mechanisms for Vodokanal activities, appropriate funds for support, and provide methodological support for the introduction of good corporate management principles. The local authorities' task was to determine a framework for the provision of the required level of Vodokanals' independence, procedures and terms for Vodokanal reform, a framework for private sector participation, as well as the measurement and monitoring of the Vodokanal service level indices. The Vodokanals had to be reformed into legally-independent enterprises that act under the control of local authorities whose services are bought in a competitive bidding process to achieve financial self-sufficiency and increase borrowing capacity.

Further activities in the Russian water supply and wastewater market showed that the reform succeeded in attracting credit funds to finance necessary investments. International loans and financing programmes amounting to about 1 bil. USD by various international financing institutions (IFIs), including the World Bank and the European Bank for Reconstruction and Development (EBRD), ensured a steady supply of funds and further encouraged private companies to participate in the market.

An example of such activities was the World Bank's loan to fourteen Russian Vodokanals within a water and wastewater project. The project's objectives were to improve water and wastewater services in the cities through investments aimed primarily at rehabilitating and improving the efficiency of existing water and wastewater systems and to strengthen the management, financial position, as well as the commercial practices and operations of Vodokanals.

More specifically, at the city level, the project sought to support the most critical and immediate investments needed to improve the operation of water and wastewater systems, while also achieving the improvement of system operations and service quality, the reduction of operational costs, and the implementation of institutional and commercial reforms that aim at improving physical system operations and the financial performance of Vodokanals.

The progress towards achieving these objectives was evaluated on two levels. At the national level, the key performance indicators were the number of participating Vodokanals able to achieve the financial targets, particularly the increases in revenue collection and cash collection, and the number of participating Vodokanals that successfully implement a cost reduction and operational improvement programmes (particularly aimed at network and demand management and wastage reduction). The impact of these programmes was measured based on the improvements of drinking water quality and energy efficiency. At the Vodokanal level, the following set of indicators was reported during the implementation process: working ratio, collection cash ratio, energy consumption (kWh/m^3), energy consumption cost (RUR/m^3), percentage of metered connections, and the percentage of samples per semester that comply with quality standards (%).

The project was originally intended to be carried out over a five-year period (May 2001-December 2005) and was to follow a two-pronged approach to ensure the improvement of

utility operations: On the one hand, the rehabilitation of a limited number of existing key elements of the operational infrastructure was planned, and on the other hand, the project sought the implementation of well-defined and critical changes in the governance, financial and managerial aspects of the Vodokanals through technical assistance support.

Considerable changes took place both in the sector and in Russia's economy in the course of the project's implementation. On a macroeconomic level, the country saw marked changes. For example, Russia's gross domestic product (GDP) in nominal terms increased from 13.2 tri. RUR in 2003 to almost 33 tri. RUR in 2007. The water sector benefited from this economic upswing in that the budgetary support for the investment needs of Vodokanals has somewhat increased. Also, the steadily rising level of personal and household incomes in Russia contributed to the improved collections, particularly cash collections.

The legal framework of the Russian water sector also underwent serious changes. In 2003, the State Duma passed the Federal Law on the General Principles of Organizing Local Self-Governance in the Russian Federation by which the responsibilities of local administrations and water enterprises in providing water services were clearly delineated. In late 2004, a package of the so-called "housing laws" was enacted including those of paramount importance for the sector such as The Housing Code, The Urban Planning Code, and the Law On the Principles of Tariff Regulation for Communal Enterprises. The impact of the latter was particularly significant since it established a uniform tariff setting paradigm for the Russian water sector and introduced a centralised multi-level tariff regulation system across the country. One year later, another Law on Concession Agreements, set the legal ground for leasing out publicly-owned communal infrastructure to private sector companies.

A first Russian national-level private operator, the Russian Communal Systems (RCS), entered the sector in May 2003 to be followed shortly afterwards by more private companies such as Rosvodokanal, Eurasian Water Partnership, Novogor-Prikamye, and others. According to the State Committee for Housing and Construction Policy (Rosstroi), the 2004 turnover in the sector was over 31 bil. USD, of which private operators supplied almost 20%. In 2007, private sector companies were present in more than 40% of Russia's 8,800 Vodokanals (World Bank, 2009).

The project has contributed reasonably towards arresting the further decline of the water and wastewater services of medium-sized cities located in different regions of Russia. Although many obstacles and difficulties were encountered during the project's implementation, it is clear that it supported the following essential building blocks in moving the selected Vodokanals towards sustainable water sector management and development:

- improvements in the efficiency of pump stations and energy efficiency (Vologda, Volkhov, Rostov, Novocherkassk, Cheboksary, Gagarin, Taganrog),
- improvement of the service quality and reduction of water losses (Rostov, Vologda, Pechora, Novocherkassk, Cheboksary, Pskov, Kungur, Chernushka),
- improvements in potable water quality (Rostov, Kungur, Gagarin, Taganrog), reduction of untreated wastewater discharge, and improvement of wastewater treatment (Ufa, Bryansk, Taganrog, Pechora),

- limited improvement of system operations, reduction of operational costs, and improvement of service quality, and
- some improvements related to institutional and commercial reforms aimed at improving physical system operations and the financial performance of Vodokanals.

Vodokanals now have a strengthened capacity with respect to the requirements and processing steps for the preparation and contracting of investments as well as construction supervision. These activities were previously performed by other government agencies, often with little consultation and interaction with the Vodokanals. Vodokanal personnel also received training in financial management and procurement procedures for World Bank financed projects, which is generally applicable to sources of external financing. Vodokanal personnel also participated in study tours to learn about modern methods of utility management and operations, planning and engineering, as well as commercial management and finance.

The majority of Vodokanals, however, remain overstaffed, technically-oriented entities with insufficient concern for efficiency, cost recovery, and other related commercial management practices. The capacity strengthening of Vodokanals extended beyond utility management: By participating in the project, Vodokanals developed more structured and comprehensive approaches to project planning, design, preparation, and implementation.

Another benefit of the project is that the outlook of the participating Vodokanal personnel changed. It expressed interest in continuing the modernisation of communal services subject to the availability of appropriate funding. Some of the effects observed include a change in the mentality of the personnel, in particular, in terms of necessity of energy efficiency efforts. In addition, the local administrations and Vodokanals developed improved skills for business planning and preparation of feasibility studies and tender documents so that they feel more comfortable with preparing projects regardless of whether they will be financed with public money or money from other financial organisations, including international ones.

Also, the impressions of service quality improved. The level of awareness about project activities and support from local citizens was rather high, even though the local administrations and/or Vodokanals did not necessarily undertake special information campaigns. It was confirmed that as a result of the physical improvements of the water supply network, the quality of water improved, which helped to decrease existing social tensions caused by the different levels of water quality among different urban districts. The construction of sewage collectors lead to decreasing accident rates and facilitated the connection of additional urban districts to these collectors. After the completion of physical works, complaints from the population declined, and Vodokanals became more efficient in reacting to and resolving accident situations.

While good progress has been made thanks to the project, a few risks remain, which may threaten the long-term sustainability of the project's impacts unless appropriate mitigation measures are put in place. The Vodokanals are in the initial stages of being transformed into autonomous entities and therefore need additional training and capacity building with regard

to administrative and fiduciary management (budgeting and accounting). Intense training for investment planning is needed as well as further support for technological advancements in the water supply and wastewater services sector. As the responsibilities for water supply and wastewater service provision are being increasingly decentralised to municipalities and Vodokanals, the role of the Ministry of Regional Development with respect to the Vodokanals needs to be reoriented towards planning, facilitation, and monitoring.

The situation in the water sector and in most of the country's Vodokanals still presents many issues and challenges. New investments are limited, maintenance is normally delayed, the sector's infrastructure continues to deteriorate, and the financial performance, despite considerable increases in tariffs, is still largely unstable. Prior to the global financial crisis, it had been expected that new borrowing by the federal government would be rather limited, whereas the use of guarantees, sub-national borrowing, and new fee-for-service arrangements for investment and policy advice would likely grow.

Consequently, there are several challenges the Russian government has to respond to.

- Firstly, additional support for the rehabilitation of water supply and wastewater systems has to be provided. Since the project only included priority/emergency works in 13 Vodokanals, many parts of these Vodokanals' systems as well as the systems in other Vodokanals are still in need of upgrade and rehabilitation. In addition, without reliable water and wastewater services, it will be difficult to implement any tariff reforms, and consumers will most likely find tariff increases unacceptable.
- Secondly, the cost recovery for water supply and wastewater services provision has to be reviewed. The financial sustainability of Vodokanals is still precarious and efforts are needed to ensure that these water utilities are able to fully cover their operating costs. Investments programmes including financing options also need to be more systematically developed.
- A third challenge is the review and continuation of institutional and policy reform of water supply and wastewater services provision. Further reform of the sector is necessary including the introduction of a more appropriate regulatory framework coupled with stronger public institutions and sector management.
- Fourthly, performance ratings and consumer satisfaction has to be considered for water supply and wastewater service provision. The opinions of consumers and their feedback have to be included more systematically into the decision-making processes at Vodokanals as well as in relation to the planned reform of the sector. Another important change is further training of Vodokanal personnel with respect to customer service, communications, and media relations; and an overview of the sector's best practices is needed. After the implementation of these suggestions, support to apply this training to local conditions in the daily operations would also need to follow.
- A fifth challenge is posed by the review of the sector reform's implementation through a Project Implementation Unit.

5. Modernising Water and Wastewater Systems: The Case of Kazans

Kazan is the capital of the Republic of Tatarstan, and it is, with 1.116 mil. inhabitants, Russia's seventh biggest city. Kazan stretches along two banks of the Kazanka river at its influx to the Volga river. As all big cities in Russia, Kazan experiences the same problems with water supply and wastewater systems. In 2006, the city's municipal water and wastewater management utility "Kazan Vodocanal" (the company) asked the EBRD to financially support priority capital investments to improve the municipal water and waste water infrastructure and services of Kazan.

The proposed project involved a loan to the municipal water and wastewater utility of Kazan. The loan's proceeds were used to finance priority capital investments to improve the city's municipal water and wastewater infrastructure and services, which contributed significantly to decreasing the level of polluting discharges into the Volga river and the Caspian Sea basin. The proposed project had an impact on the transition process through:

- corporatisation and commercialisation of the company,
- billing according to actual consumption, and
- transfer of skills during the implementation phase including the procurement, design, installation, and contract supervision in accordance to the best available international engineering practice.

The borrower was the municipal water and wastewater utility "Vodocanal." A senior rouble loan was equivalent to 350 mil. RUR (26 mil. EUR) with two priority investments: the upgrade of wastewater treatment plants and the rehabilitation of wastewater pumping stations.
The project includes three investment components:

- rehabilitation of the main wastewater treatment plant to enhance its operational efficiency and to improve sludge dewatering,
- rehabilitation of the Iskohz wastewater pumping station, and
- construction of new networks in a new housing area.

As stated in the project summary document, the EBRD classified the project B/1 for the first two components. Component three of the priority investment programme was classified as IEE (Intelligent Energy Europe) and required further environmental investigations prior to disbursement of the bank's funds toward this component. The level of further investigations depended on the location and scale of the new networks. The project was predominantly associated with the rehabilitation of the existing structures. That resulted in limited adverse environmental impacts and in significant environmental benefits, which could be readily identified and quantified in an environmental analysis. As this project involved existing facilities, an environmental audit had also been undertaken (EBRD, 2007).

The environmental appraisal was based on a review of the environmental audit and analysis sections of a feasibility study of Kazan's municipal water and waste water services, which was prepared by Poyry Environment in January 2007. The environmental audit revealed that Vodocanal's operations were generally well-organised and managed. Environmental, health,

and safety (EHS) issues were addressed and dealt with systematically, and a clear system of allocation of EHS responsibilities exists, in particular in the areas related to waste management, chemicals management and laboratory, garage, and workshop operations. The existing EHS management system was compliant with the applicable Russian laws and regulations.
Major issues of environmental concern were, first of all,

- inadequate sludge disposal and treatment in the disposal areas, sludge fields, and landfills. The sludge fields were almost full, and if disposal was continuing there, one could expect a breakdown of the embankments of the sludge ponds resulting in sludge flowing into the surrounding residential areas and the Volga river. The disposed sludge at the sludge fields was an environmental and safety hazard for humans and animals in the area because it was not fenced and one could not walk on the surface of the sludge.
- A second environmental concern was that the sludge fields generated a considerable amount of methane emissions into the atmosphere. Proper management of the sludge reduced these emissions.
- Thirdly, there was also an environmental risk of wastewater exfiltration from the sewer system and overflows from pumping stations of poor condition, which posed a significant risk of soil contamination and a hygienic risk to the population in the vicinity. Further measures and financial resources were required to reduce the environmental risks caused by that.

Carefully selected measures partly addressed these environmental issues of concern by improving the overall condition of the main wastewater treatment plant and upgrading the pumping station. The environmental investigations showed that the project would result in significant energy efficiency and environmental improvements, and that any adverse environmental impacts would be limited. The project was structured to meet Russian and EU environmental standards and adequate mitigation measures were incorporated into the project's design. However, it should be noted that the project alone was not able to achieve the full compliance of Vodocanal's operations with the EU's environmental standards as much greater financial resources would have been required for that (estimated at 600 mil. EUR). Further projects focussing on sludge disposal and management issues are under consideration.

There were no adverse impacts associated with the implementation of the Priority Investment Programme. Construction-related impacts are likely to be localised, short-term in nature, and they were efficiently prevented or mitigated by applying international construction practices and planning. The project improved wastewater collection and treatment facilities and resulted in better quality of effluent and energy savings. The operation significantly contributed to decreasing the level of polluting discharges into the Volga river and the Caspian Sea basin.

An Environmental Action Plan (EAP) was developed to help the company and the city to implement the priority investment project in an environmentally sound and sustainable manner as well as to guide them towards the long-term goal of providing wastewater services which meet EU and Russian standards for effluent discharges. The EAP identified further measures that would be needed for the existing water and wastewater treatment facilities to meet these

standards and helped prioritising the most cost-efficient measures to improve EHS conditions in water and wastewater management in Kazan. One of the EAP measures also addressed the existing sludge disposal and management problems by introducing temporary environmentally sound and safe measures until a proper solution for final disposal could be arranged.

Environmental information on the project was disclosed to the public in accordance with the planning and construction procedures of Russian law. No environmental impact assessment was required for the planned scope of the project under components one and two. Environmental information for the third component of the priority investments programme was disclosed at a later stage once more information on the location and scale had been provided to the bank and once appropriate environmental investigations had taken place. In the context of the EBRD's participation in the project, this environmental summary was disclosed locally at Kazan Vodocanal and Kazan's offices and local media, as well as in English on the EBRD website.

Kazan Vodocanal continued monitoring its performance in accordance with Russian regulatory requirements. The company reported to the EBRD annually on the measured environmental impacts and on the implementation of the EAP mitigation measures. The bank evaluated the project's compliance with the applicable environmental and social standards during the project's duration by reviewing these reports. The EBRD also conducted monitoring visits to the project when and if deemed appropriate.

6. The New Governmental Programme "Clean Water" as a Federal Response to Future Challenges

Russia plans to invest 20 bil. USD in water management and infrastructure by 2020. The pledge was made by Prime Minister Vladimir Putin following an accident at the country's largest hydroelectric plant, which claimed the lives of nearly 100 workers. The accident occurred in 2009 when a surge of water burst through Soviet-era turbines and flooded the turbine room where the workers were located. The Russian water sector has suffered from chronic underinvestment for years, with much of its infrastructure dating back to Communist times. This accident was a major wake-up call to the country's leadership who now realises that the status quo is simply not an option.

In 2008, the Russian government put forward a plan known as the Clean Water programme as a major overhaul of the country's water and sewage infrastructure over the next ten years. It was estimated at the time that as much as 15 tri. RUR (459 bil. USD) would be required to complete all necessary upgrades, refurbishments, and new constructions. A fall in oil prices and the global economic slump put a damper on the plans, but the Sayano-Shushenskaya accident hastened the authorities to act (Ministry of Economic Development of the Russian Federation, 2008).

It is unlikely that the country will ever be able to provide the 459 bil. USD for the required works, but the 20 bil. USD pledged by Putin are at least a start. The Clean Water programme sets out ambitious goals and highlights the magnitude of the task. Public access to water and sewage networks is still relatively low in Russia compared to other European countries, and there has been little progress in improving the situation since the end of Communist rule.

While announcing the investment plans in 2009, Boris Gryzlov, the chairman of the State Duma, added that there is still a top-level estimation for the programme's implementation, but further details are yet to be announced by the federal government. The initial draft of the programme published in 2008 indicates ambitious goals (cf. Fig. 4) and mirrors the scope and magnitude of the needs of the Russian water sector.

Figure 4. Key goals of the Clean Water programme (according to the 2008 draft)

Goals to Achieve	2010	2017
Percent of Population with access to centralized water supply	78.2%	90.0%
Water losses in the centralized water suppöy network (%)	18.5%	15.0%
The proportion of population consuming drinking water of good quality	71.3%	83.2%
% share of wastewater that meets requirements	40.3%	68.3%
The share of spending on capital investment in expenditure pattern of water utilities	15.0%	40.0%

Source: http//www.mosvodokanal.ru.

As stated above, public access to water supplies and sewerage networks is still low in Russia, with over 20% of the population being without access to centralised water supply and over 60% of wastewater discharges not meeting requirements. More importantly, little progress has taken place over the last two decades. Regulatory agencies are faced with limited resources and have little or no control over the indiscriminate discharge of untreated industrial wastewater into water reservoirs. This has resulted in the deterioration of the water quality with a negative impact on the health of Russian citizens. According to the UN World Population Prospects, Russia has the shortest average life expectancy in Europe. However, the deteriorating quality of drinking water in Russia has become a significant concern during recent time. Duma Chairman Gryzlov expects that the implementation of the Clean Water programme over the next decade is likely to lead to a tangible improvement in the water environment and increase the life expectancy in Russia by five to seven years.

With massive capital requirements, the implementation of this infrastructure programme is a challenge, particularly during a period of severe economic downturn. Poor economic conditions also affect the performance of Russia's water sector. Initially, the plunge in manufacturing output translates into a decrease in the industrial sector's water consumption, which accounts for over 60% of water use in Russia. The crisis also hit average Russian households by influencing their income level and stretched their ability to pay for water bills.

Turmoil in the banking sector has influenced the availability of bank financing for water companies as well. At the moment, credits in Russia are very expensive with an interest rate of 22% to 25% per year. As a result, many enterprises have to stop their leasing operations. Until 2008, it was fairly easy to buy new machines or technology with lease agreements; right now, it is impossible. Difficulties in the access to funding also encompass loans for key investment programmes.

Securing the necessary capital is critical for ensuring the implementation of the Clean Water programme. Still, there has always been a hiatus between available funds and actual investments required by Russian water utilities, regardless of the country's economic situation (Zagdan, 2009).

The involvement of the private sector is not an option to consider but rather a necessity to ensure even a partial realisation of the programme. Structural changes need to be initiated at the federal level to provide a framework endorsing public-private cooperation. Plans to amend the concession law are only a first but very important step towards achieving the goal. Last but not least, the water tariff policy in Russia will require revision. The current level of tariffs is insufficient to cover the necessary capital costs required for the programme's implementation.

Providing the necessary funding for the programme's implementation currently remains beyond the capacities of municipalities and the federal government. Luckily, Russian authorities have demonstrated an increasing understanding of this challenge and aim to encourage more private sector involvement in the water business. Local authorities will now be interested in finding a good partner for the crisis years. With economic growth, it was easy to solve problems in the water sector. Right now, it is necessary to work on a different level: the anti-crisis level. First of all this means the managerial level and in this situation, privately-managed operators are more effective than municipal companies.

Private sector involvement and effective management are essential to implement the Clear Water programme, particularly when utilities are expected to improve operational efficiencies and increase the share of capital expenditures. Authorities recognise the significance of the private sector's involvement and are already working on amendments to the concession law to promote and facilitate private investments for the utility sector. Changes in regulations are necessary as existing legislation on concessions has not delivered the desired results.

Crisis and budgetary constraints also push utilities to consider alternative ways of increasing effectiveness or reducing operational costs. Promising short and medium-term measures, such as managerial and engineering work, aims at improving operational effectiveness, reducing water loss due to leakages, and increasing energy efficiency. Crisis is a good time for increasing effectiveness. That is why engineering companies that attempt to reduce costs have good chances in Russia. If the crisis in the construction sector continues they will not need new facilities and thus private water and wastewater enterprises do not need to invest. It is necessary to change investment plans and focus on energy-efficient machinery and water

losses. Right now, in this sector, good management is more important than investments. First of all, the managerial system in these companies has to be modernised and only afterwards can investments come to the fore.

The water sector in Russia provides a significant business opportunity for another important reason: security of ownership, which is typically one of the key market entry barriers for domestic and foreign investors. No investor must be afraid of such processes in the Russian water sector because most of it is municipal. At present about 15% of the Russian water sector are privately owned; actually the municipal sector has no interest to get back these assets. In the municipal sector there is a lack not only of capital but also of human resources, of know how to organise public utilities in an efficient way. The crisis has worsened quite a number of problems in the municipalities so that many of them are even interested to get rid of the responsibility for the water sector.

Russian authorities face the tough challenge of obtaining the necessary funds for the Clean Water programme. It is evident that the staggering 459 mil. USD mentioned by Duma Chairman Gryzlov is a sum likely to stretch Russian government resources, particularly due to current economic conditions. So involvement of the private sector is not an option to consider, but rather a necessity to ensure even a partial realisation of the programme. Structural changes need to be initiated at the federal level to provide a proper framework endorsing public-private cooperation. Plans to amend the concession law are the first and important step toward achieving the goal. Finally, the water tariff policy in Russia will require revision. The current level of tariffs is insufficient to cover the necessary capital costs associated with the implementation of the programme. In the short term, the socially sensitive aspect of low tariffs is likely to prevail, thereby putting any increase of tariffs on hold. In the medium to long-term future, however, a change of perspective at the federal level will be required, not only to enable the necessary capital for investments but also to ensure that water operators can exist independently without requiring subsidies to cover operational expenses.

Nevertheless, despite this harsh reality and these challenges, the perspectives for the Russian water sector for the next years are rather promising compared to what has been witnessed over the last decade. Water utilities already demonstrate an increasing interest in managerial privatisation. The construction and rehabilitation of infrastructure between 2010 and 2017 are expected to create new opportunities for equipment suppliers, engineering firms, as well as construction companies. Private operators already cater to 15 mil. Russians or about 10% of the population, which means that they have huge potential for growth. The specific feature of the Russian water market is that it is controlled by national businesses (private operators), with international companies and financial organisations only trying to get a foothold. Tariffs in Russia are growing rapidly and will soon reach European levels, which makes the country more attractive for international operators and financial structures. As a result, competition for contracts is becoming tougher. Even with all the gloom and doom around the Russian economic climate, the water sector has the potential to be better off over the next decade than it has been in the past decade.

7. Conclusion

Besides its huge reserves of fresh water the Russian water sector suffers from a number of shortcomings and inefficiencies. Russian authorities have demonstrated an increasing understanding of this challenge and aim to encourage more private sector involvement in the water business. The reform of the housing and public utilities sector has been in progress for more than 10 years now. It started the transformation of the formerly monopoly-dominated sector towards entrusting the public utility infrastructure to the most effective managers, towards healthy competition, but with public controls kept in place. Only recently has the government put the desolate technical infrastructure of the water and wastewater sector on the agenda and started a vast programme to modernise water management and infrastructure. However, the experience with the reforms confirms that the modernisation of municipal water and wastewater treatment systems cannot be limited to simply investing in infrastructure and changing the regulations of this sector, but instead requires a whole set of reforms: revision of written rules, changes in the attitudes of all main stakeholders which are affected by socio-economic changes, changes in institutional arrangements, and changes in the functioning of federal and local authorities, Vodokanals, and consumers. For modern Russia the priorities are, on one hand, modernisation of water and wastewater utilities by using the instruments of public-private partnership, and on the other hand, changes in the system of government that will support active public participation in this process.

References

EBRD (2007), Kazan Municipal Water and Wastewater Loan, European Bank for Reconstruction and Development, London, available at: http://www.ebrd.com/projects/index.htm, accessed March 3, 2010.

FSSS (2010), Basic Indicators of Mining and Quarrying, Manufacturing, Electricity, Gas and Water Supply, Federal State Statistics Service of the Russian Federation, Moscow, available at: http://www.gks.ru/wps/portal/english, accessed March 3, 2010.

IMF (2009), Russian Federation: 2009 Article IV Consultation – Staff Report; Staff Statement; Public Information Notice on the Executive Board Discussion, International Monetary Fund, Washington, D.C.

Ivanov, S. and Sivayev, S., (2007), Municipal Water and Waste Water Services Reform in the Russian Federation (IWA Publishing).

OECD (2008), OECD Environmental Outlook to 2030, OECD, Paris.

OECD (2008), OECD Insights: Sustainable Development: Linking Economy, Society, Environment, OECD, Paris.

OECD (2008), OECD Sustainable Development Studies: Conducting Sustainability Assessments, OECD, Paris.

OECD (1999), Environmental Performances Reviews. Russian Federation 1999, OECD, Paris.

Ministry of Economic Development of the Russian Federation (2008), Clean Water Governmental Programme (project), Moscow.

UN-HABITAT (2006), Best Practices: Delivering High Quality Fresh Water to the Entire Population of the City of Yaroslav, United Nations Human Settlements Programme, available at: http://www.unhabitat.org/downloads/docs/6570_72261_CityofYaroslav.pdf, accessed March 3, 2010.

UNEP (2000), International Source Book On Environmentally Sound Technologies for Wastewater and Stormwater Management, United Nations Environment Programme, Osaka, Japan, available at: http://www.unep.or.jp/Ietc/Publications/TechPublications/TechPub-15/main_index.asp, accessed March 3, 2010.

World Bank (2009), Russian Federation: Municipal Water & Wastewater Project, Washington, D.C.

Yashechkin, S., Svetlitsky, S. (2008), Eurasian Water Partnership – Russia to Initiate Clean Water Program, available at: http://rbth.ru/articles/2008/05/28/2008_05_WP_07_waterprogr.html, accessed March 3, 2010.

Zagdan, T. (2009), Market Insight: Water sector outlook for Russia, Frost & Sullivan analysis, available at: http://www.rosvodokanal.ru/en/press-center/aboutus/index.php?id4=1176,

Zhmur, N. S. (1999), Water Supply and Sanitation Techniques, Monthly scientific-technological bulletin (Russian Federation), No. 12.

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List of Abbreviations

AoM	Association(s) of Municipalities (AoM)
CBA	Community Based Approach (to local development)
CEE	Central and Eastern Europe
CF	Cohesion Fund
CFC	Chlorofluorocarbon
COD	Chemical oxygen demand
EAP	Environmental Action Plan
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEC	European Economic Community
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIC	Environmental Investment Centre
EHS	Environment, Health, and Safety
ERDF	European Regional Development Fund
EU	European Union
FB	Final Beneficiary
FDI	Foreign Direct Investment
FIDIC	Federation International des Ingénieurs
GDP	Gross Domestic Product
HELCOM	Helsinki Commission
IEE	Intelligent Energy Europe

IFI	International Financial Institutions
IMF	International Monetary Fund
ISO	International Organization for Standardization
ISPA	Instrument for Structural Policies for Pre-Accession
MJ	Megajoul
MNC	Multinational Corporation
MNE	Multinational Enterprise
MOE	Ministry of Environment
MOF	Ministry of Finance
MSU	Management Support Unit
NEP	National Environment Programme
NWMP	National Waste Management Plan
OPEX	Operational expenditures
p.e.	population equivalent: a measure of pollution representing the average organic biodegradable load per person and day
PLN	Polish zloty
PPP	public-private partnership
R&D	Research and Development
ROC	Regional Operating Company
RUR	Russian ruble
USD	United States dollar
USMU	Upper Silesian Metropolitan Unit
WWTP	Waste Water Treatment Plant