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Assistance in environmental policies and NEAP implementation in CIS countries

Financing strategy for municipal wastes management sector in Rostov oblast

Analysis of the existing situation and development scenarios

July, 2004

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Annexes:

Abbreviations and Acronyms

CIS	Commonwealth of Independent States
C&D	Construction and Demolition
DANCEE	Danish Co-operation for Environment in Central and Eastern Europe
DSW	Domestic solid wastes
EFS	Environmental Financing Strategy
EIA	Environmental impact assessment
FEASIBLE	Financing for environmental, affordable and strategic investments that bring on large-scale expenditure
GRP	Gross regional product
HCS	Housing and Communal Services
HH	Household
JSC	Joint-Stock Company
SUE / MUE	State / Municipal Unitary Enterprise (special legal status of publicly-owned enterprises)
MW	Municipal waste
OECD	Organization for Economic Co-operation and Development
O&M	Operations and Maintenance
RO	Rostov Oblast (province of Russia)
RUR	Russian Rouble
SMART	Specific, measurable, affordable, realistic and time-bound (about targets)
TACIS	Technical Assistance to the Commonwealth of Independent States
t., t/y	Tones, tones per year
th.	Thousand
WWTP	Wastewater treatment plant

Executive summary

The situation of waste management in Rostov Oblast (RO) stems from a variety of features:

- The industrial waste comprise the lion share of all waste generated in RO, while half of it is generated from coal extraction, and cannot be utilized in any way. Thus the issues of industrial waste minimization, neutralization and disposal, or utilization remain crucial;
- As for domestic waste, it is mostly disposed of in poorly operated dumpsites, and in landfills that do not comply with current Russian standards (except Rostov-on-Don). The situation worsens, with the increase of waste production, and the inclusion of hazardous waste in domestic waste flow. The whole system is hampered by the poor economic and contractual relations between the economic agents. The consequences of poor waste management and disposal are manifold, on soil, air, water, landscape… They indirectly impact on human health as well.

The situation requires that both infrastructure and service are improved, using simple, not very costly technologies, planned and implemented at regional and inter municipal level.

Technologies which are most appropriate for Rostov Oblast rely on collective collect points, and landfills. Indeed, this and similar studies have established that in the case of Rostov Oblast, regional waste incineration is inadequate. Among the key arguments against the construction of an incinerator, one can refer to low population density, the availability of proper sites for waste disposal, the consequences of capital and transportation costs on tariffs and affordability.

Therefore, the extension of existing landfills, and the construction of new ones, all at Russian standards, is a prerequisite. Sorting would also have most favorable consequences, as the sale of recyclables would generate extra revenues; this requires that separate waste collection is implemented, and sorting stations are set up in bigger cities where waste flow is sufficient to make the recyclables business profitable.

The financial analysis developed in the report shows that such programs are both desirable and feasible. Indeed, calculations show that the revenues generated by waste management services in Rostov Oblast exceed the expenses of utilities, even in the baseline scenario. It follows that the industry is potentially attractive for private business.

Moreover, affordability is not an issue, since current tariffs are well below the affordability threshold set by the World Bank for similar territories. Indeed, there is room to increase tariffs, if service and environmental performance improve at the same time.

Two issues have to be tackled, before this dynamics ignite:

- Episodic financial gaps. They are likely to result from an uneven distribution of expenses and revenues over time. Simple financial arrangements could make sure that these gaps are not disruptive in the long run;
- Inter municipal cooperation. Such an institutional arrangement would bring substantial cost savings, at operational and capital levels.

The report investigates some arrangements that are likely to stimulate these dynamics. In particular, it supports lease contracts, whereby inter-municipal landfills is leased to a private operator, and lease revenues are shared by municipalities proportionally to their contribution to capital investments. Contributing municipalities will jointly approve economically justified and sustainable tariffs for each consumer group.

1 Introduction

The present financing strategy (FS) has been prepared in co-operation with the Ministry of Economic Development and Trade, the Ministry of Natural Resources of the Russian Federation and the Government of Rostov oblast (province) in the framework of a TACIS Project called «Assistance in implementing environmental policies and NEAP in CIS countries» (hereafter referred to as NEAP-2 project), with support from the Organization for Economic Cooperation and Development (OECD), which played a key role at the final stage of the project. The project was implemented by BCEOM (a French Engineering Consultancy), Halcrow Group Ltd., and COWIconsult International Limited.

The Russian Component of the NEAP-2 project focused mainly on two sectors: municipal waste management (MW), and municipal water supply and wastewater (WSWW). Consequently, under agreement with the Government of Rostov oblast, two financing strategies have been worked out: one for the municipal waste management[1], and another for urban water supply and wastewater services.

This report presents major results, key findings and recommendations of the financing strategy (FS) for the municipal waste management sector.

The objective of the financing strategy is to define an affordable level of services, and to demonstrate how the related costs could be financed.

The FS has been designed by a Working Group of experts under a Steering Committee chaired by Mr. Vladimir F. Timchenko, Head of the HCS Department in the Rostov oblast government.

The financing strategy methodology (see Annex 7) allows to elaborate a long-term (10-20 years) program to finance operation and capital expenditure, including a priority capital investments program, for which expenditure needs are balanced with the available financial resources.

In the FS methodology, it is of primary importance to determine sector development targets, and a scenario to achieve the targets. Thus, the targets should be in line with the environmental priorities of the oblast; they should be specific, measurable, realistic, time-bound and affordable from a financial point of view. Each scenario is based on a particular capital investments program to achieve the targets.

FS tools include the FEASIBLE computer model[2], which calculates

- operation expenditure needs for reliable operation and proper maintenance of the existing and new MW infrastructure, including expenses for routine and capital repairs, and
- capital expenditure needs for construction, extension and rehabilitation of existing infrastructure, as well as for assets renewal in line with the depreciation rates.

These expenditures needs are then compared with the expected amount of financial resources, and the model calculates the resulting “financing gap”.

[1] According to the definition in the Federal Waste Catalogue (Goscomecologia of Russia Ordonance of 27.11.97 No. 527), municipal waste (MW) includes, apart from the domestic solid waste generated by households: waste of similar content generated by institutions (offices, educational institutions, cultural and sport facilities), at railway and bus terminals, airports, harbors, commercial waste, as well as consumption waste of industrial enterprises. Moreover, MW also include street and markets cleaning waste, green waste, construction and demolition waste, water and wastewater treatment waste, domestic liquid waste, and non-hazardous medical waste.

[2] Financing Strategy methodology and FEASIBLE model were elaborated by **COWI,** under guidance of OECD Secretariat and with financial support of the Government of Denmark.

The analysis of the financing gap considers not only the magnitude of total cash flow deficit, but also its break down into types of expenditure, such as capital investment (rehabilitation and extension), maintenance and operational expenditure. This knowledge of the "structure" of the financing gap is important to understand where the main bottlenecks are, and when additional policy interventions are mostly needed.

The financing strategy is defined through series of iterative runs of the FEASIBLE computer model, with different assumptions on actions to take to mobilize additional finance, or to re-allocate available funds, and/or to revise the sector development targets or scenarios.

The present document has been discussed and approved at the final workshop involving members of the Steering Committee, of the Working Group of experts, and stockholders in Rostov oblast. It has been subsequently presented to the HCS Department in the Oblast Administration.

The financing strategy is expected to be a useful tool for strategic and current planning, environmental policies elaboration and implementation, for planning of public investments in the MW infrastructure, as well as for management practices improvement.

The strategy helps policy makers to select priority projects and activities most compatible with the environmental priorities of the sector, and to achieve the sector objectives, to estimate project costs, and to match the required and available financial resources.

This will facilitate optimization of capital and operation expenditure in MW management. This will also improve effectiveness and efficiency of public expenditure in the industry, as well as planning of development, rehabilitation and modernization of the municipal economy. It might help attracting more financial resources for the MW sector.

The opinions expressed in the present document belongs to the members of the Working Group of experts and are not necessarily shared by the Rostov Oblast Government, TACIS and OECD.

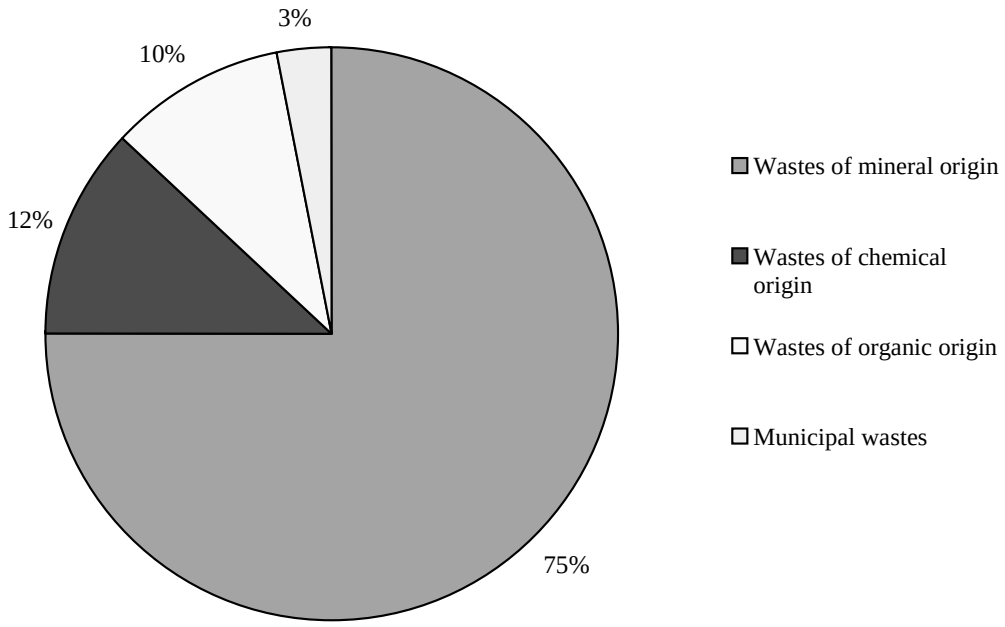
2 Existing situation, key challenges for waste management in Rostov oblast

2.1 Generation, disposal and utilization of waste

The structure of waste production in Rostov oblast (RO) is as follows (percentage of total waste; see diagram 2.1):

- Industrial wastes: minerals – up to 75%, chemical waste - 12%;
- Domestic solid wastes - about 3%;
- Agricultural waste, including cattle breeding - up to 10%;
- Accumulated and outdated fertilizers and pesticides - up to 5%.
- Medical wastes - *not registered*.

Figure 2.1 Structure of waste production in Rostov oblast (by sources of generation)



The most urgent environmental challenges in waste management in RO are the following:

- Utilization and neutralization of industrial waste;
- Disposal (storage, burial) of waste which could not be utilized in any way, including obsolete pesticides.

2.2 Industrial waste

2.2.1 Industrial waste generation and disposal

About half of industrial waste generated in the oblast is related to coal extraction and enrichment, and cannot be utilized in any way. It usually ends up at slug heaps, which occupy the area of more than 1,000 hectares, where more than 400 million tones of waste have accumulated over the years.

Ash-and-slag wastes (ASW) generated by energy sector are disposed at ash dumps of the total area of 250 hectares storing more than 40 million tones of waste. The greatest contributor of ASW is Novocherkasskaya State electric power station, which accumulated 831,800 tones of ASW in 2001 (more than 10% of industrial waste annually generated in RO), of which only 1.2% was recycled. The 3-storeyed ash dump occupies 196 hectares and stores 41.6 million tones of waste.

Among the most hazardous waste types generated all over the oblast is mercury, mainly contained in outdated fluorescent lamps. Since 1994, such waste has been processed (with mercury extraction) at Donetsk Manufactura JSC (Donetsk, RO), and Promecologia JSC (Rostov-on-Don). However, collection, temporary storage and transportation of such lamps by educational, medical, housing, commercial institutions are not regulated yet, which results in illegal dumping together with domestic solid waste.

The greater part of industrial and agricultural wastes of Hazard Classes 2 and 3 is made of oil wastes, oil slug, spent lubricants, varnish-and-paint wastes, and galvanic sludge.

2.2.2 Industrial waste neutralization, recycling and utilization

The following waste treatment facilities operate in Rostov oblast:

- Facilities for regeneration of polyamide film residuals, copper-bismuth catalyst residuals, ***spent of industrial and transformer oils*** (Novocherkassky Plant of Synthetic Products);
- Unit for granulation of natrium sulfate (capacity of 14,300 t/year), which processes annually up to 30,000 tones of sulfate waste from chemical industries (Volgodonsk);
- Facility for neutralization of extremely hazardous *(*Hazard Class 1) waste: sludge ***oil tar of kilns***, operated since 1998 at Novocherkassky Electrode Plant, with capacity of up to 300 t/year for waste containing *benz-a-pirene*;
- Facility for utilization of ***residual vitrified brick***, from kilns repair, at Novocherkassky Electrode Plant (11,460.2 tones of slime was recycled in 2001).

Oil wastes are partly utilized:

- At oil salvage facilities located at industrial enterprises, large petroleum storage depots, transport stations;
- As additives or fuel, in enterprises using liquid fuels.

However, many production facilities in the oblast do not use technology to utilize and neutralize oil waste. Utilization of galvanic sludge is quite problematic, since the main pollutant is chrome and heavy metals.

Techniques for water and wastewater sludge utilization are being implemented very slowly. This results in overloading of sludge drying beds, and sludge storage reservoirs, which become pollution sources themselves. Nevertheless, in 2001, a wastewater sludge dewatering plant of 120 t/day capacity was constructed and put into experimental-industrial operation at Vodocanal MUE (municipal water utility), in the City of Rostov-on-Don.

2.3 Municipal waste management

Each year, RO generates more than 1 million tones of consumption waste, 70% of which is domestic solid waste (DSW), which are mainly disposed of at poorly operated dumpsites/landfills. These landfills are built without leach protection systems, and often located in environmentally and sanitary unfavorable sites, e.g. in water protection zones, sand pits with high ground water levels, etc.

Problems in municipal waste management are conditioned by the existing situation with waste generation, and relations between economic actors dealing with consumption waste disposal.

The key factors negatively influencing the situation include:

- Constant increase of DSW, due to the development of small and medium sized enterprises and households activity;
- Unstable composition of such waste, due to the inclusion of hazardous waste;
- Disposal of DSW on unauthorized dumpsites, not complying with sanitary and environmental requirements;
- Lack of rehabilitation and extension of overloaded, outdated DSW disposal facilities and dumpsites.

The institutional arrangement for collection, storage, treatment, disposal and registration of DSW in the oblast is the following.

2.3.1 DSW collection

DSW collection and removal from settlements are carried out by municipal utilities, which own special equipment and vehicles, and operate waste disposal facilities (landfills, dumpsites).

According to the data collected from questionnaires filled for the FS survey, there are 10,000 waste collection points, with some 17,000 containers installed, which amounts to some 50% of the required capacity. Over 70 % of the waste collection points and containers are located in urban areas. The containers are neither cleaned nor disinfected.

DSW collection services cover from 60% to 100 % of households in cities and from 4% to 70% in rural areas. Frequency of DSW removal ranges from 1 to 12 times every two weeks. In cities, waste is collected every day.

Average distance of DSW removal increases annually by 0,5 km, thus resulting in the increase of waste transportation cost.

Utilities collecting specialized waste lack the vehicles for collection and transportation. There are some 1,000 vehicles (including tractors), of which only half is operating, while the rest is always under repair. In urban areas the following waste collection vehicles are used: КО-413, КО-415, 430, 404, 440, ZIL, GAZ, KAMAZ. In rural areas, the wastes are collected and transported by dump-trucks, lorries and tractors.

There is no separate DSW collection system for households.

2.3.2 DSW treatment - infrastructure

There are only 2 waste sorting plants in the oblast: Rostov Waste Utilization Facility JSC (capacity=70,000 t/year) in Rostov-on-Don and SEDAN Plant (capacity=30,000 t/year) in Taganrog.

In Rostov oblast, DSW is disposed of in sanitary landfills. This method has some advantages:

- It is a routine practice, that does not require complex and expensive equipment and high level of personnel skills;
- It is the cheapest way to manage MW;
- It has a local environmental impact which can be minimized through low cost measures;
- The disturbed landfill area can be restored, when disposal and remediation technologies emerge.

The method obviously has disadvantages as well:

- Difficulties in selection of an appropriate site for DSW disposal, taking into account hydro geological conditions, soil and other features of the area;
- This is not an environmentally friendly method of waste utilization;
- Rehabilitation and soil remediation requires a long period.

DSW is disposed generally at authorized dumpsites (totally 270 landfills in RO, occupying more than 300 hectares), which have not been designed properly. Indeed, they have no design documentation, no groundwater and surface water protection systems; often, they fail to comply with environmental requirements, i.e. they are located in water protection zones, in sand pits, or in territories with high groundwater levels (such dumpsites are marked as “type C”). In addition, there are 180-200 illegal dumpsites in RO.

Very few landfills comply with Russian sanitary, environmental, and construction norms (called “type B” landfills in the FEASIBLE model); one is in Rostov-on-Don.

2.3.3 DSW treatment - operation

Quality control of DSW which are dumped in landfills is only visual (if any), allowing combined disposal of domestic, hazardous, and medical waste.

Operation of landfills and authorized dumpsites doesn't comply with sanitary-hygienic and environmental requirements, i.e. DSW is neither compacted nor buried layer-by-layer in the beds; the beds are not properly maintained; access roads are not adequate; there are no sanitary protection zones; the landfill and the adjacent lands are sometimes ***littery***.

Municipal utilities operating landfills for DSW often do not pay attention to technological and operating requirements. This causes fires, smoldering of decomposing wastes, and generates air pollution.

Poor condition of DSW disposal sites, as well as illegal dumping of waste in the environment, result in soil contamination, surface and ground water and atmospheric air pollution, odors and landscape nuisances. Moreover, the existing waste disposal practices contribute to deterioration of environmental situation in general and negatively impact on human health. However, this impact is usually indirect, mediated by contaminated water and air.

In addition, uncontrolled digestion of uncovered and non compacted domestic waste is a nutrient medium for pathogenic organisms, such as bacteria, fungi, helminthes, and for their carriers – insects, rodents and some bird species. This is an extra risk for human health, especially for the staff working on the landfills and dumpsites.

The environmental monitoring system is basically lacking, in most cases.

2.3.4 The case of rural areas

Illegal all-round dumping is widespread in rural areas, where DSW is neither collected nor removed. In summer, large volumes of waste are generated near “dachas” (summer houses), which are not covered by waste collection services.

Households not covered by DSW removal systems have to take care of their waste collection and disposal themselves. Composting is the most usual way to utilize organic waste for households; however, it is not generally applied practice today. Combustible waste is usually incinerated, which emits toxic substances in the atmosphere. The rest is disposed of at dumpsites, randomly arranged near settlements. From time to time, utilities responsible for sanitation collect such waste, and transport it to authorized landfills and dumpsites.

2.4 Recyclable wastes

In RO, there is no regional system to collect recyclable waste (recyclables). There is very little information on the amount of recyclables generated, collected and utilized in RO, or exported from the oblast.

In the cities of the oblast, there are stationary and mobile collection points for scrap metal, glass waste, waste paper and cardboard, obsolete accumulators, old clothes. ***The first recyclables collection points have been established in Rostov-on-Don by Rostov Waste Processing Complex JSC.***

In the framework of the present project, 50 enterprises and organizations dealing with collection, transportation, and processing of recyclables filled out a special questionnaire on recyclables and the existing waste management system.

90% of these institutions were utilities dealing with collection and transportation of scrap metal; 10% were enterprises collecting or processing paper and cardboard, waste paper, old clothes, plastic wastes, tires, accumulators, glass. 10 enterprises of Rostov-on-Don answered the questionnaires: Trade Port JSC, Paper Mill JSC, Mirror production plant, Rostovvtorpererabotka CJSC, Rostovbumaga CJSC, Rostov Folding Carton Plant JSC, Umchermet CJSC, Rostov Glass Factory CJSC, Yugmetal JSC, Rosvtormet JSC.

The table below reports on the aggregated data collected during the survey, on recyclables collected and sold outside the oblast in 2001.

Table 2.1 Recyclables sold outside Rostov oblast in 2001

No.	Recyclables	Sold in 2001, tones
1	Paper	180
2	Cardboard	139
3	Tires	136
4	Glass	214
5	Metal: Ferrous Non-ferrous	 215,050 2,972
6	Polyethylene	47

Source: data from questionnaires

2.5 Options for improvement of the existing system

The existing system for MW management is ineffective, from both the environmental and safety points of view. It requires immediate measures to address the most critical problems. However, due to limited financial resources, it is not relevant to introduce strategies based on complex (and therefore expensive) waste treatment technologies; ***nor is it possible to support end-of-pipe waste recycling***. The situation necessitates comprehensive interventions, which could promote a considerable improvement in the sector performance at relatively low costs.

2.5.1 Waste collection and disposal

In order to improve the existing situation it is necessary:

- To develop a system of centralized collection and transportation of DSW, and to ensure that it covers all urban and rural households. This is relatively easy to implement, as small and medium sized towns already have systems for DSW collection covering multi-storied buildings. The most economically effective way is arrangement of DSW collection points with stationary containers in residential areas, which could serve private houses located at the distance of 100-120 meters;

- To organize separate collection of hazardous waste from households and small enterprises, to make sure that such waste is not dumped in DSW landfills;

- To collect wastes more frequently (where required);
- To develop inter-municipal cooperation through construction and joint operation of waste disposal facilities, which would comply with current national sanitary and environmental requirements.

2.5.2 Waste treatment and disposal

At present, there are only few well-operated waste treatment and disposal facilities in Rostov oblast. Lack of financing makes landfills the most widespread way to treat municipal waste in the short to long-term perspective. Accordingly, a realistic MW management strategy should aim at safe disposal, burial and storage of waste, through rehabilitation of existing facilities and construction of new ones, taking into account the present requirements for an environmental friendly way of disposing waste.

Sanitary and environmental indicators of the existing landfills performance can be improved by introduction of such technologies as waste compacting and coverage, avoiding nuisances and reproduction of insects and rodents. The consequences on human health would be most favorable.

2.5.3 Recyclables collection and utilization

In the short-term, only minor developments in recyclables collection and utilization in Rostov oblast are expected. However, some cities such as Rostov-on-Don and Taganrog have already organized waste sorting and recycling systems.

The level of development of this activity depends on the demand for recyclables. To date, demand for recyclables in RO is rather slim, and there is little prospect for a sharp increase in the near future. Effective recycling system requires that economic tools are developed and implemented to finance a comprehensive waste recycling program.

Organic waste composting is likely to be spread among private households, both urban and rural, if municipalities elaborate and disseminate the appropriate training programs on low cost composting, which is safe for the environment and human health.

3 Assumptions for a financing strategy

In order to analyze municipal waste management in Rostov oblast, and to discuss realistic development opportunities, some parameters have been chosen that restrain the range of analysis and specify objectives and deadlines. The baseline year is 2001. The forecasted period is 15 years, and all calculations are made for 2001-2015.

3.1 Rostov oblast delineation for model simulations

The simulation only deals with cities and districts which provided the most complete answers to the questionnaires. Total population in these cities and towns comprises some 3.13 million people, i.e. 70% of the total population in the oblast.

The selected localities were divided into three groups, based on their status, municipal waste management objectives, and financial capabilities. The composition of the three groups is presented in the table below.

Group 1 **Capital city, and its suburbs**	**Group 2** **Other large and medium sized cities in the oblast**		**Group 3** **Rural areas**
Rostov-on-Don and itssurburbs	Goukovo Shakhti Azov Volgodonsk	Novoshakhtinsk Tsimlyansk Krasny Soulin Bataysk	18 districts (see below)

Group 3 includes 18 rural districts:

- Verkhnedonsky
- Oktyabrsky
- Matveyevo-Kurgansky
- Krasnosulinsky
- Yegorlyksky
- Ust-Donetsky
- Kouybishevsky
- Rodionovo-Nesvetaysky
- Bokovsky
- Semikarakorsky
- Konstantinovsky
- Zernogradsky
- Aksaisky
- Zimovnikovsky
- Tarasovsky
- Chertkovsky
- Tacinsky
- Orlovsky

3.2 Situation and waste production, by groups of cities

The table below sketches the current situation.

Table 3.1. Some indicators of MW management system in Rostov oblast, 2001

	Group 1	**Group 2**	**Group 3**
Population (person)	1 803 000	804 000	672 000
Coverage by DSW collection services (%)	70% - urban	64% - urban 39% - rural	63% - urban 40% - rural
Existing disposal facilities	DSW landfill	DSW landfills and dumpsites	Dumpsites
Applied waste collection methods	Conventional collection method[3]; collection points for glass, paper, plastic; collection centers for other recyclables		

Source: Data from the MW management enterprises

[3] Conventional DSW collection method = mixed wastes are collected in containers or regularly delivered to collection trucks according to certain time-schedule

Using the data on waste production from different industry, an annual waste generation level was determined for each group, by industry and for households.

Table 3.2. Municipal waste generation from different sources, Rostov oblast, 2001

Source of waste generation	**Group 1**	**Group 2**	**Group 3**
Urban population, t/y	440,850	217,394	42,541
Urban population, kg/cap/y	244.4	300.5	174.4
Rural population, t/y	-	11,902	115,932
Rural population, kg/cap/y	-	147.9	271.1
Industry, t/y	50,056	101,287	10,668
Trade and services, t/y	91,246	96,637	65,589
Construction and demolition, t/y	78,148	16,243	210
WWTPs (wastewater sludge), t/y	na	na	na
Total, tones/year	**660,300**	**434,464**	**234,940**

Source: Model calculations based on the data from the enterprises

3.3 Baseline Scenario

Each scenario is based on a set of targets and the deadlines for their achievement, as well as on a set of demographic, macro-economic, financial and other assumptions [4]. Each group of cities has specific objectives and targets which should be achieved within a certain period of time. The objectives of each group are different (that was one of the delineation criteria), and they will be presented separately. At the same time, there are objectives and preconditions common for all groups.

3.3.1 Waste accumulation model

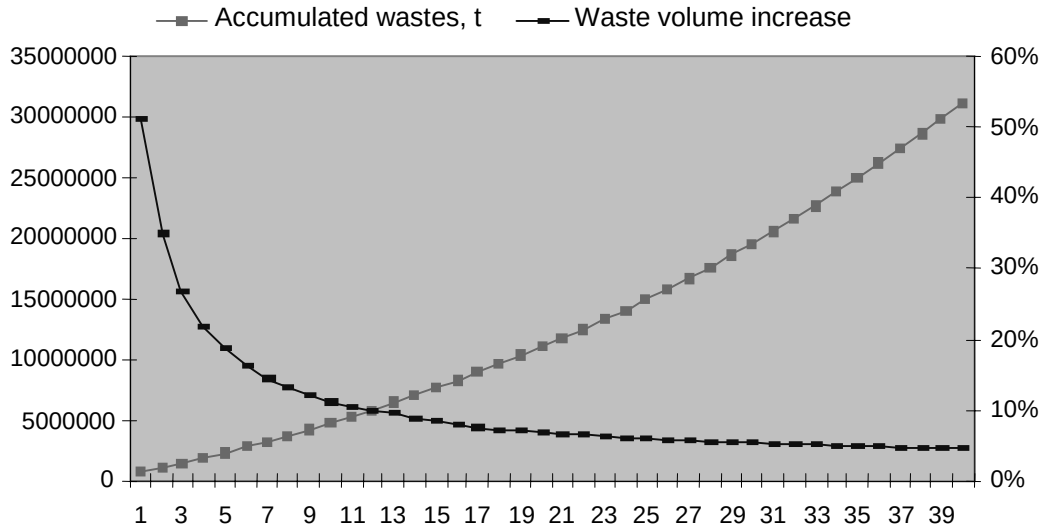
Waste generation volumes are calculated in FEASIBLE, based on the data for all cities in the group. However, the data were not available for all cities, thus COWI experts used the following waste accumulation model: waste accumulation process can be expressed in power dependence of accumulated waste volume upon number of years of accumulation $y = 0{,}5436 \cdot x^{-0{,}6779}$ (a dark line). Dependence of waste increase on time is expressed as polynomial function of the 2-nd order $y = 11917 \cdot x^2 + 280711 \cdot x + 618969$ (a light line), where:

x = number of year of accumulation, from 1 on;

y = waste volume increase in % of the previous year volume.

[4] For details on the assumptions and how they are used in the model please, see (COWI, 2004)

Figure 3.1 Waste accumulation model



Source: COWI calculations

3.3.2 Forecasted waste production

Non-food waste production is expected to increase in line with of GRP and households income. The story is different for food waste: based on the experience of Western Europe, it is assumed that growth in household incomes will first result in an increase of food waste per capita; however, this volume will stabilize at some point; this is mainly caused by the spreading of packed foodstuff, the use of which will promote decrease of food waste due to semi-finished food products (convenience foods) consumption.

In EU countries, in 2000, the annual production of food waste amounted to 135 kg/capita in urban areas, and 65 kg/capita in rural areas. According to experts estimate, the same level of waste production will be achieved in Rostov oblast in 25 years. Table 3.3. presents the forecasted volumes of waste calculated by the model for the year 2015.

Table 3.3 Waste production from all sources in 2015, Rostov oblast (FEASIBLE estimate)

Source of waste generation	**Group 1**	**Group 2**	**Group 3**
Urban population, t/y	736 200	373 634	83 342
Rural population, t/y	-	119 638	164 593
Industry, t/y	99 107	200 541	21 121
Trade and services, t/y	180 660	191 335	129861
Construction and demolition, t/y	154 727	32 160	498
WW sludge, t/y	-	-	-
Total, t/y	**1 170 694**	**817 307**	**399 418**

Source: Model calculations based on the data from enterprises

Annex 5 contains model calculations for the production of waste by sources, and for composition of waste, until 2015.

3.3.3 Waste collection and sorting system

It is assumed, that, until 2015, the existing waste collection system, i.e. waste collection to the containers installed in special sites, or delivery of wastes to collection trucks at certain established time, will remain unchanged for all groups.

It has not been possible to take into account the waste sorting points already in operation, nor the ones under construction in 2001 (Volgodonsk, Shakhti, Novoshakhtinsk,

Tsimplyansk, Azov). Indeed, reliable data is missing on both their full capacity, operations and the expected part of recyclables. Therefore, waste sorting is not assumed in the Baseline Scenario for all groups. All collected wastes are considered to be dumped in landfills.

3.3.4 Coverage of oblast population by municipal waste collection services

The simulation is based on the assumption that average coverage by waste collection systems remains at the level of the base year (2001), i.e.

- 70% for group 1;
- 64% for the urban component of group 2 cities;
- 39% for the rural component of group 2 cities;
- 63% for the urban component of group 2 cities;
- 40% for the rural component of group 2 cities.

3.3.5 Waste disposal

In the model, it was assumed that capacity of each new landfill (or new sections of the existing landfills) should be enough to dispose the generated waste during 40 years after putting the facility into operation.

3.3.6 Specific targets for Group 1

The Group 1 (Rostov-on-Don with suburbs) already has a landfill complying with current Russian sanitary and environmental requirements. Therefore, the target for Group 1 is merely a proper/adequate operation and maintenance of this landfill, as well as a gradual extension of its capacity based on the waste volumes disposed.

3.3.7 Specific targets for Group 2

The population living in municipalities of Group 2 is quite large and is expected to grow.

Table 3.5 Settlements of Group 2

Locality	Population
Volgodonsk	185,200
Tsimlyansk	15,800
Azov	80,000
Bataisk	93,300
Krasny Soulin and districts	72,900
Shakhty	244,200
Novoshakhtinsk	39,200
Goukovo	73,600

Source: Rostov oblast Statistical Committee

It is the unanimous opinion of the Steering Committee and the Working Group that, for Group 2, it is necessary to shut down the existing dumpsites, and to build new DSW landfills, which would comply with the national construction, sanitary and environmental requirements. This target was included in the Baseline Scenario. However, there are various options regarding the number, capacity and dates of commissioning of the new landfills.

Hydro-geological situation across Rostov oblast varies a lot. In particular, there are many areas with unfavorable hydro-geological conditions, in particular those with sand layers. Thus, hydro-geological factors often make it difficult to identify sites for MW disposal. In particular, this is a very urging issue for Group 2.

Inter-municipal cooperation may help to find a solution (see chapter 6 below). However, it was not considered in the baseline scenario.

The table below descries the targets for Group 2 regarding replacement of the existing dumpsites with new landfills of Class B (i.e. landfills complying with current national construction, sanitary and environmental requirements) for a 15-year period.

Table 3.6. Planned construction of new municipal waste disposal facilities for next 15 years

Plans for construction/reconstruction of DSW disposal facilities	
Goukovo	The existing landfill until 2006. After 2007 – a new landfill with capacity = 2,600 thousand tones
Novoshakhtinsk	The existing dumpsites until 2007. After 2008 – a new landfill with capacity = 2,198 thousand tones
Shakhty	The existing dumpsites until 2008. After 2009 - a new landfill with capacity = 8,636 thousand tones
Tsimlyansk	The existing dumpsites until 2003. After 2004 - a new landfill with capacity = 549 thousand tones
Azov	The existing landfill until 2002. After 2003 – rehabilitation and extension of the existing landfill to total capacity of 8,175 thousand tones
Krasny Soulin	The existing disposal facilities until 2004. After 2005 – construction of new section or a new landfill with total capacity of 5,484 thousand tones
Volgodonsk	The existing landfill until 2009. After 2010 – a new landfill with capacity = 4,666 thousand tones
Bataisk	The existing landfill until 2001. After 2002 – extension of the existing or construction of a new landfill with a total capacity of 3,499 thousand tones

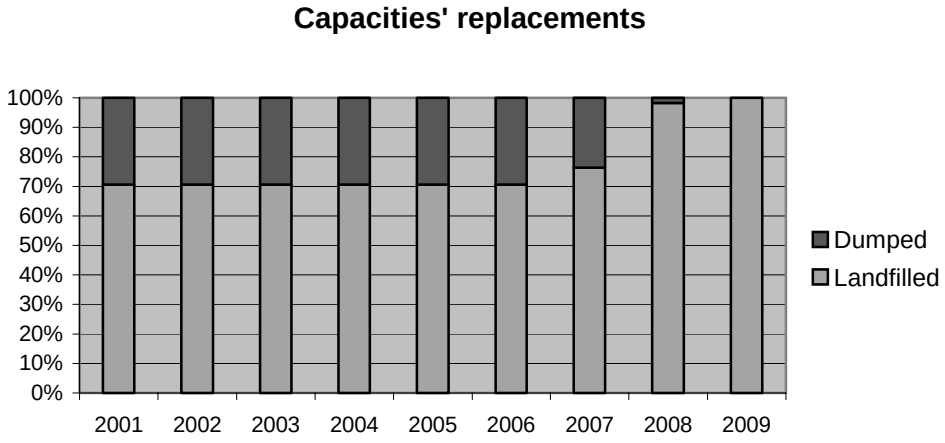
The table below presents the share of cities in the total volume of MW accumulated in Group 2, required capacity and dates of commissioning of new landfills (with no inter-municipal cooperation).

Table 3.7 Share of cities in the total volume of MW accumulated in Group 2, required capacity and dates of commissioning of new landfills (with no inter-municipal cooperation)

	Azov	Goukovo	Novoshakhtinsk	Shakhty	Tsimlyansk	Krasny Soulin	Volgodonsk	Bataisk
Share of the city in the total volume of waste accumulated in Group 2, %	24.9%	7.0%	5.8%	22.0%	1.7%	15.7%	11.2%	12%
Required capacity of a landfill, th.t	8 175	2 600	2 198	8 636	549	5 484	4 666	3 499
Year of new landfill commissioning	2003	2007	2008	2009	2004	2005	2010	2002

The figure below presents the capacities replacements in the forecasted period, including construction of new facilities.

Figure 3.2. Scheduled replacements of dumpsites with new landfills in Group 2, and changes of the waste flow onto the disposal facilities (existing dumpsites and new landfills)



Reference: Share of MW landfilled and dumped

DW:	2001	2002	2003	2004	2005	2006	2007	2008	2009
Landfilled	70.6%	70.6%	70.6%	70.6%	70.6%	70.6%	76.4%	98.3%	100.0%
Dumped	29.4%	29.4%	29.4%	29.4%	29.4%	29.4%	23.6%	1.7%	0.0%

It is assumed that shares of cities in the total MW generated in Group 2 would remain unchanged during the whole forecasted period. It is expected that waste disposal facilities will be extended to meet the demand, or new facilities with the same parameters will be constructed.

3.3.8 Waste haulage and transfer stations

Based on the analysis of the collected data and the assumptions, it has been presumed that the weighted average distance of additional transportation to the final collection point (or waste disposal site) in groups 1 and 2 will not exceed 15 km. Thus, the construction of waste transfer stations will not be required. Costs of DSW transportation on this distance were not included in the calculation of the cost of waste collection and disposal.

3.3.9 Waste incineration plant ?

Estimations made for other oblasts with similar geographic features (e.g. Novgorod oblast) indicate inexpediency of construction of oblast waste incineration plant, as capital cost, cost of waste processing at the incineration plant, as well as haulage costs for transportation of waste from other localities will be too high, which will generate a considerable (manifold) increase of the tariff for waste removal. Therefore this expensive solution was not included in the simulations.

3.4 Macroeconomic and financial assumptions

A set of demographic, macroeconomic and financial assumptions were designed, which is common to all scenarios.

3.4.1 Population

In the near future, population in the selected cities and districts is assumed to be around 3,126,000 people. Due to the harder social and economic situation in rural areas, the rural population is expected to migrate to cities and to decrease more rapidly than the urban

population. Therefore, the situation in Group 3, where rural population prevails over urban settlements in baseline year, will change: it is assumed that rural population will decrease and the urban population will subsequently increase.

Population forecasts for the planning period are presented in the next table.

Table 3.8. Population in the Groups 1-3 – changes over 2001-2015

	Group 1		Group 2		Group 3		Total	
	2001	**2015**	**2001**	**2015**	**2001**	**2015**	**2001**	**2015**
Population, th. p.	1,803	1,805	804	807	672	670	3,126	3,126
Urban population in apartment houses	70%	75%	66%	72%	28%	30%	71%	72%
Urban population in private houses	30%	25%	24%	20%	8%	11%	11%	11%
Rural population	-	-	10%	8%	64%	59%	18%	17%

Source: data from questionnaires and consultants estimates

3.4.2 GRP growth rate and structure

The real GRP growth rate in Rostov oblast is expected to be at 5% per annum on average over 2002-2015, and the real household income will grow at the same rate.

Lacking statistical data on GRP structure in each group, the Consultant has assumed that industries and services (non-market services in particular) sectors inputs in Group 1 and Group 2 are higher than an average value for the oblast, whereas agricultural sector input in Group 3 is much higher than in Group 1 and Group 2. GRP structure by industry is expected to be stable until 2015. The assumptions are summarized in Table 3.9.

Table 3.9 GRP volume and structure in selected settlements, 2001.

	GRP in 2001, mil. RUR	**Industry**	**Trade and services**	**Construction**	**Agriculture forestry**
Group 1	59 000	37.0%	52.0%	8.0%	3.0%
Group 2	25 464	30.0%	40.0%	5.0%	25.0%
Group 3	20 000	25.0%	35.0%	5.0%	35.0%
Reference:					
Total for RO	***127 300***	***23%***	***50%***	***5%***	***20%***

Source: Statistical Yearbook for Rostov oblast, 2002, Consultant's estimate

3.4.3 Final consumption

The share of households' consumption in the GRP is expected to decrease down to 70% from the base year level of 80%, while the share of services in the final consumption will increase up to 16% compared to 12% in the baseline year (see table 3.3).

Table 3.10 Households' consumption expenditures in Rostov oblast

	2001	**2005**	**2008**	**2012**	**2015**
Final consumption, in % of GRP, of which:	**80%**	76%	73%	70%	70%
Goods, %	***88%***	*86%*	*85%*	*84%*	*84%*
Services, %	***12%***	*14%*	*15%*	*16%*	*16%*

Source: Statistical Yearbook for Rostov oblast, 2002, Consultant's forecast

The estimated share of urban population in final uses is given in Table 3.11.

Table 3.11 Share of urban and rural households in final consumption in Rostov oblast, 2001

	Group 1	Group 2	Group 3
Share of urban population	100%	93%	68%
Share of rural population	-	7%	32%

Source: Consultant's estimate

3.5 Assumptions on MW management financing

3.5.1 Public financing of current and capital expenditure in the industry

Budget funding for MW management was calculated on the basis of data on incomes and expenditures of the consolidated public budget of Rostov oblast, as well as on the data presented by waste management utilities in the oblast. The budget funding in 2001 amounted to 104.5 million RUR, which constituted only 0.5% of the Rostov oblast consolidated budget, or just 0.1% of GRP (see Table 3.12).

Table 3.12 Budget financing of HCS and MW management sector in Rostov oblast, 2001

	Million RUR	% of budget expenditures	% of GRP
Total public budget revenues	**19,760**		
Public expenditures, total:	**20,188**		**20.0%**
Including:			
Capital	3,230	16.0%	
Operation	16,958	84.0%	
Expenses for HCS, total:	**2,539**	**12.6%**	**2.5%**
Including:			
Capital	534	2.6%	
Operation	2,005	10.0%	
Expenses for MW management sector, total:	**104.5**	**0.54%**	**0.1%**
Including:			
Capital	1.2	0.006%	
Operation	103.3	0.51%	

Source: Ministry of Finance of Rostov oblast and MW management utilities in Rostov oblast, 2001

The Baseline Scenario presumes that public budget funding of MW management will increase in line with GRP growth rate, i.e. 5% per annum (on average, in 2001 prices).

Here are some important comments for expenditure needs calculations for each scenario:

- If waste production grows as fast as GRP and households incomes, this will increase current expenditure needs for waste removal and disposal;
- The appropriate maintenance of the fixed assets and existing service level will require more expenditures for capital repair and modernization of the fixed assets (or asset renewal, where needed).

3.5.2 Payments for services

Data on revenues of municipal waste utilities (utilities specialized in waste collection, or multy-activity HCS utilities) from payment for the services has been presented by utilities from each municipality. The data includes information on the billed amounts, payments collection rates and paid bills, for each waste producer. The data reveals a share of cash payments and a real value of non monetary arrangements (in % of nominal value).

Data for base year 2001 is presented below for the whole Rostov oblast and for each group of cities individually.

Table 3.13 Revenues of the utilities from the services on domestic wastes removal, Rostov oblast, 2001 (thousand RUR)

Source	Billed amount	Collected amount	Collected in cash	Total value of collected amount (cash equivalent)
Urban population	100,907	94,627	92,661	94,234
Rural population	3,104	2,570	2,399	2,536
Budget-financed and commercial institutions	55,982	53,374	45,411	51,782
Industry	18,514	16,784	15,106	16,448
WWTP	1,413	1,358	962	1,278
Total	179,920	168,713	156,539	166,278

Source: Data from the enterprises provided in the questionnaires

Group 1

Group 1 includes Rostov-on-Don and adjacent district. The table below contains data on revenues from domestic wastes removal services in the cities of Group 1.

Table 3.14 Revenues of the utilities from domestic waste removal services in Group 1, Rostov oblast, 2001, (thousand RUR, including VAT)

Source	Billed amount	Collected amount	Collection rate	Cash share	Real value of non-monetary arrangements (% of nominal value)	Total value of the collected amount (in cash equivalent)
Urban population	77,832	73,019	**94%**	100%	80%	73,019
Rural population	-	-		-	-	
Budget-financed and commercial institutions	28,341	26,924	95%	90%	80%	26,386
Industry	15,547	13,992	90%	90%	80%	13,712
WWTP	-	-	-	-	-	0
Total	121,720	113,935	**94%**	100%	80%	113,117

Source: Data from the enterprises provided in the questionnaires

Notes:

- The collection rate was accepted as 100% even when the answer was above 100% (due to offset of outstanding debts from the previous years);
- In case of a lack of data on the real value of non monetary arrangements, 80% of nominal value was taken as an estimate.

Group 2

The Group 2 includes Volgodonsk, Tsimlyansk, Azov, Bataysk, Krasny Soulin (city and district), Shakhty, Novoshakhtinsk. The table below contains data on revenues from domestic wastes removal services in the cities of Group 2.

Table 3.15 Revenues of the utilities from domestic wastes removal services in Group 2, Rostov oblast, 2001, (thousand RUR, including VAT)

Source	Billed amount	Collected amount	Collection rate	Cash share	Real value of non-monetary arrangements (% of nominal value)	Total value of the collected amount (in cash equivalent)
Urban population	20,920	19,665	**94%**	90%	80%	19,272
Rural population	934	841	**90%**	90%	80%	824
Budget-financed and commercial institutions	13,397	13,129	98%	70%	80%	12,341
Industry	2,365	2,365	100%	90%	80%	2,318
WWTP	1,312	1,312	100%	70%	80%	1,233
Total	38,928	37,312	**96%**	82%	80%	35,988

Source: Data from the enterprises provided in the questionnaires

Group 3

The table below contains data on revenues from domestic waste removal services in the cities of Group 3.

Table 3.16 Revenues of the utilities from domestic wastes removal services in Group 3, Rostov oblast, 2001, (thousand RUR, including VAT)

Source	Billed amount	Collected amount	Collection rate	Cash share	Real value of non-monetary arrangements (% of nominal value)	Total value of the collected amount (in cash equivalent)
Urban population	2,155	1,943	90%	100%	80%	1,943
Rural population	2,170	1,729	80%	95%	80%	1,712
Budget-financed and commercial institutions	14,244	13,321	94%	90%	80%	13,055
Industry	602	427	71%	90%	80%	418
WWTP	101	46	46%	95%	80%	45
Total	19,272	17,466	91%	98%	80%	17,173

Source: Data from the enterprises provided in the questionnaires

Hypotheses on increase in tariffs and revenues of domestic waste removal and disposal utilities in the Baseline Scenario are presented below:

- Tariffs for all consumer categories (in real terms and constant 2001 prices) will increase in line with growth of GRP, assumed at 5% a year, therefore, the share of household expenditures dedicated to domestic waste collection and removal services will remain unchanged.
- The collection rate for MW removal and disposal services is assumed to remain at the level of the base year.
- As households coverage remains at the level of the base year, the above mentioned hypotheses mean that real revenues of the utilities from the service will also increase in line with increase of waste generation volumes and tariff rates.

The assumptions made under other scenarios are stated in the subsequent sections.

Due to a lack of data for Group 3 necessary for FEASIBLE model simulation, ***all scenarios were simulated only for Group 1 and Group 2.***

4 Modeling results - the Baseline Scenario

4.1 Group 1

4.1.1 Required funding for MW management sector

The expenditure needs for municipal waste removal and disposal services (including expenditure on collection and transportation of waste, on operations at DSW landfill, and maintenance and capital repair of the assets) for Group 1 for the given period are estimated in the model as **3,850** million RUR, including:

- 3,415 million RUR for domestic waste collection and transportation and landfill operation;
- 435.5 million RUR for maintenance and repair of the assets, and construction of new sections at the existing landfill.

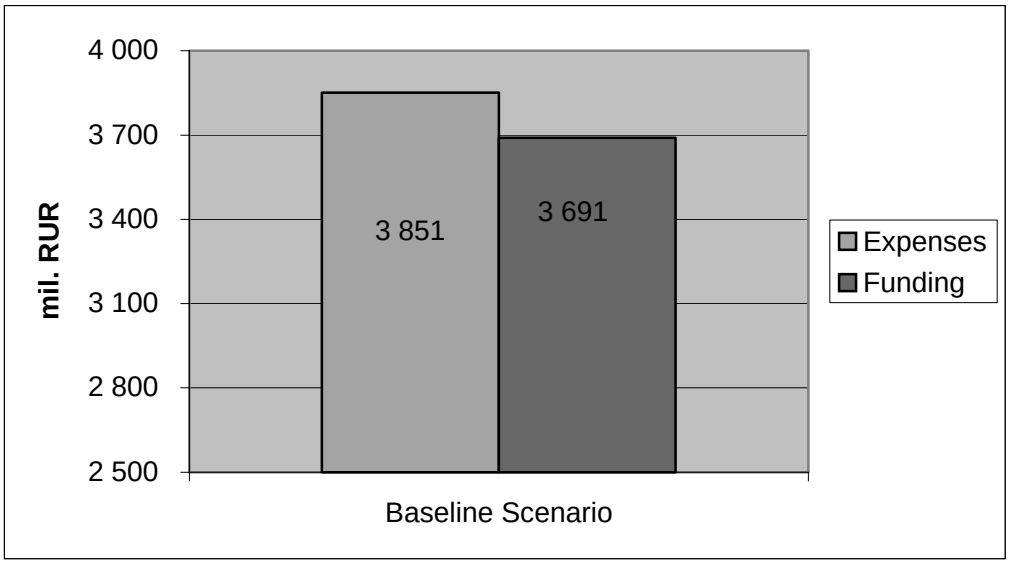
4.1.2 Financing options for MW management sector

Budget financing and utilities revenues in the Baseline Scenario are assumed to grow in line with the GRP growth, whereas the collection rate from households will remain unchanged (94%). Given such assumptions, the expected revenue of the waste management utilities in Group 1, over 2001-2015, is estimated at **3,691** million RUR (see Figure 4.1). The households payments will constitute 1,657 million RUR (45%).

4.1.3 Financial analysis

In general, within the established period, Group 1 will demonstrate a minor **financing gap** (160 million RUR), however some surplus is observed in *particular years*.

Figure 4.1. Total expenditure needs and supply of finance for MW management sector in the cities of Group 1 over 2001-2015



Source: Model calculations

This gap apparently results from the fact that current tariff rates for households cover just about 90% of factual costs for collection and removal of domestic waste and their disposal at landfills.

This financial outcome for Group 1 doesn't mean that each utility (specialized waste collecting utilities) will face this financing gap every year. For instance, in case one utility is

responsible for sanitation cleaning of the city territory and for DSW removal, while another one is a landfill operator, then one of them may bear losses (especially, if sanitation cleaning is poorly financed from the municipal budget), while another (a landfill operator) may enjoy profit.

However, the relatively small financing gap in Group 1 could be covered by minor increase of budget funding (by 2 million RUR per year), by increase of payments collection rate for budget-financed institutions (up to 100%) and for industrial and commercial companies (to 95%), as by a simultaneous 10% rise of household tariff. It is shown below that such a rise would remain within the affordability limit.

Possibility to cover the financing gap in a short-term creates financial preconditions to set sector development targets, including extension of the existing DSW landfill, development of separate collection and sorting of waste, and separate collection of recyclables, as well as renovation of the vehicle fleet (procurement of heavy waste transportation trucks with compactors).

Besides, this possibility indicates that MW management industry might be commercially attractive for private business, and therefore there are good opportunities for competitive environment development that will help improve performance indicators and optimize operation expenditure and capital investments.

4.2 Group 2 – «No inter-municipal cooperation» scenario

4.2.1 Required funding for MW management sector

The expenditure needs for municipal waste removal and disposal services (expenditure on collection and transportation of waste, on operations at DSW landfill, and maintenance and capital repair of the assets) for Group 2 for the given period are estimated in the model at 894,3 million RUR (see Annex 6), including:

- 578.2 million RUR on waste collection and transportation, and on operations at dumpsites and landfills;
- 316.1 million RUR to maintain and to repair the assets, and to construct new landfills.

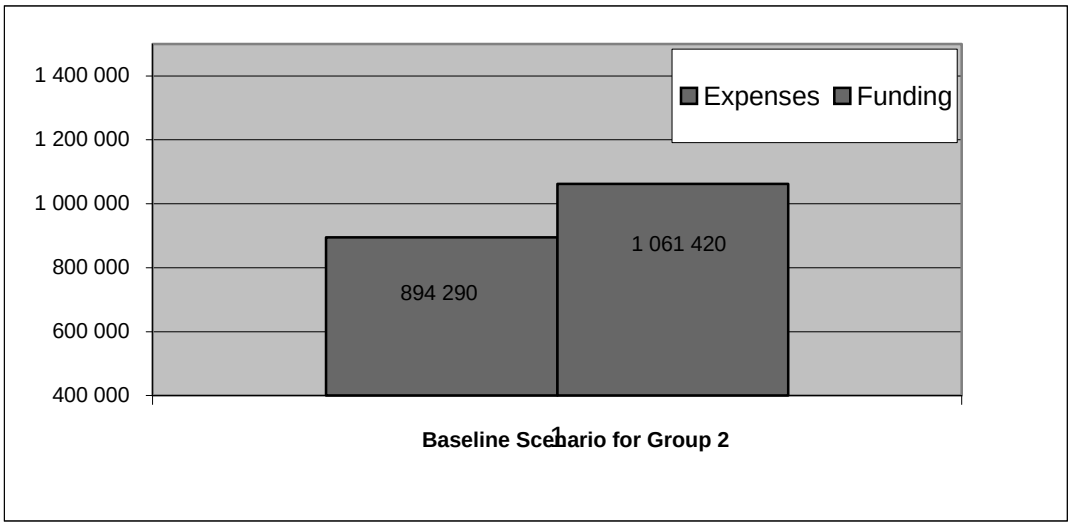
4.2.2 Finance available for MW management sector

In the Baseline Scenario the expected revenue of the utilities from municipal waste removal services for Group 2 for 2001-2015 is estimated at 1,061.4 million RUR (see Figure 4.2); the households' payments will amount to 356.3 million RUR (34%).

4.2.3 Financing gap analysis

For Group 2, the model calculations show (see Annex 6) that incomes will be higher than expenditures over the whole period. This result is quite unexpected, at it is obtained in the situation of relatively low tariff rates for DSW removal for households.

Figure 4.2. Total expenditure needs and supply of finance for MW management sector in the cities of Group 2 over 2001-2015



Source: Model calculations

However, collection and utilization of domestic solid waste is currently carried out not only by specialized waste collecting utilities, but also by multipurpose HCS utilities. Many multipurpose utilities do not have separate accounts for each activity. This makes it difficult to assess financial efficiency of MW management activity, even for one single multipurpose utility. Therefore, some assumptions and experts estimates were used in the modelling. If these assumptions are correct, it can be stated that in general for Group 2 the MW management activity taken alone (that is, separated from street cleaning and provision of other HCS) would be a profitable business.

To be more precise, with the existing low level of operations related to existing waste disposal facilities, the current tariff revenues fully cover current expenditure of waste collection and disposal, though the required capital investments in construction of new facilities (landfills, sorting and transfer stations etc.) can not be fully funded from the revenues.

In such a situation, MW management as a separate business could be financially attractive. This could facilitate involvement of private sector and private investments into this industry.

Proper operation of the existing facilities and construction of new landfills complying with the national construction, sanitary and environmental requirements will increase expenditure needs and, upon the expected tariffs growth, will lead to decrease in operating profits of the utilities. But this is the only way to ensure sustainable performance of the sector in the long-term.

Opportunities for optimization of capital investments in MW management based on inter-municipal cooperation in Group 2 are considered in the subsequent scenario.

4.3 Affordability of payments for waste removal service for households

According to the World Bank assessments, payment for services on domestic waste removal and disposal is considered as affordable, if the payment doesn't exceed 0.75% of the average household income (the threshold could be 1.7% in some cases when the service is especially valued by the consumers)[5].

[5] (S Cointreau-Levine (1994), Private Sector Participation in Municipal Solid Waste Services in Developing Countries. Volume 1 - The Formal Sector. UMP Technical Paper, No. 13. The World Bank, Washington. ISBN

In order to estimate the share of households' expenditure dedicated to municipal waste management services in Rostov oblast, a comparative analysis of data on tariffs in Rostov oblast and statistical information on final consumption of households in Russia has been carried out6.

The table below contains data on shares of payments for municipal wastes management services in households' expenditures for end user's consumption. The greatest share of end user's consumption expenditures belongs to the households consisting of 5 persons and more.

Table 4.1 Households' structure and end user's consumption expenditures in 2002

	Expenses for final consumption (per person) RUR/month*	**Expenses for final consumption (per household) RUR/year**	**Average payment for municipal waste management services in Rostov oblast in 2002, RUR/year (incl. VAT)****	**Share of expenses on domestic waste collection and removal in HH consumer expenditure (%)**
Household, on average	2,372	-	-	-
Household consisting of 1 person	3,242	38,904	61.37	0.16%
Household consisting of 2 persons	2,838	68,112	122.74	0.18%
Household consisting of 3 persons	2,713	97,668	184.11	0.19%
Household consisting of 4 persons	2,179	104,592	245.48	0.23%
Household consisting of 5 persons and more	1,593	>=95,580	>=306.85	≥ 0.32%

Sources: *Russian Statistical Yearbook (2003), p.191
**Administration of Rostov oblast

The average tariff (incl. 18% VAT) used in the above table for calculations was derived from the information presented by Rostov oblast Administration. The calculations used average value; however there are considerable differences in tariff levels by districts and cities of the oblast.

An average annual payment for domestic waste management services per capita was obtained by multiplying the tariff by the waste accumulation norm equal to

- 1.4 m³ (per capita per year) for houses with all conveniences,
- 2.2 m³ for ill-equipped dwellings.

In order to estimate an average share of households' expenditures for waste management services, information on average size of household in Rostov oblast (2.8 persons in 20027) was used. This served as a basis to estimate an average share of expenditure for MW management services in total expenditures of the households. This share amounted to 0.19%, as it is shown in the table.

[6] due to a lack of data on household expenditure distribution, the data on the households expenditure on final consumption were used. This is seen as being correct, as the estimations did not include only savings of the households, which are not considerable in Rostov oblast. Lacking the required data on Rostov oblast, the average values for Russia have been used.

[7] Report of Russian State Statistical Committee «the Results of All-Russian Population Census in 2002».

For comparison, a share of expenditure on DSW services as % of average HH income has been estimated and made up 0,17% of the average HH income in 2002. (Note that in RO, in 2002, the average household income amounted to RUR 3,072 per capita per month).

Table 4.2 Average share of DSW services in total consumer expenditures of the households in Rostov oblast in 2002.

	Average value for a household of 2.8 people
HH consumption expenditures (per household), RUR/year	91,157
DSW services payments (per household), RUR/year	172
DSW services payments share in the HH consumption expenditures	0.19%

Compared with the affordability limits established by the World Bank (0.75% - 1.7% of the average income), payments for the domestic wastes removal in Rostov oblast in 2001-2002 on average were more than affordable for households, and there is even room for considerable tariff increase within the affordability limit. In particular, a suggested tariff increase by 10-15% would be quite affordable for households (for a overwhelming majority of them), which would allow to achieve 100% coverage of actual costs for the domestic waste removal and disposal.

5 Inter-municipal cooperation development scenario

5.1 Description of inter-municipal cooperation development scenario in Group 2

Another scenario envisages active cooperation of municipalities in Group 2 to optimize costs, through inter alias reduction of the required number of MW landfills. This scenario was proposed by representatives of the Working Group and was called Inter-municipal Cooperation Development Scenario.

Upon the proposal of the Working Group, the municipalities in Group 2 were further delineated into subgroups, each of them to be provided with one municipal landfill.

The table below presents the objectives stated in the scenario as for the replacement of the existing dumpsites with new Type B landfills (i.e. landfills complying with current Russian construction, sanitary and environmental norms and standards) for a 15-year period.

Table 5.1 The planned commissioning of new facilities for municipal wastes disposal over 2001-2015

Planned construction/reconstruction of DSW disposal facilities		**(Average) distance to the landfill**
Tsimlyansk	Till 2004 - the existing waste disposal facilities,	5 km
Volgodonsk	since 2005 – inter municipal landfill of 3,326 th.t capacity at Tsimlyansk	20 km
Azov	Till 2003 - the existing waste disposal facilities,	30 km
Bataysk	since 2004 – intermunicipal landfill of 12,445 th.t capacity at Bataysk	5 km
Goukovo	Till 2006 - the existing waste disposal facilities,	33 km
Novoshakhtinsk	since 2007 – intermunicipal landfill of 18,705 th.t capacity at Krasny Soulin	34 km
Shakhty		27 km
Krasny Soulin		19 km

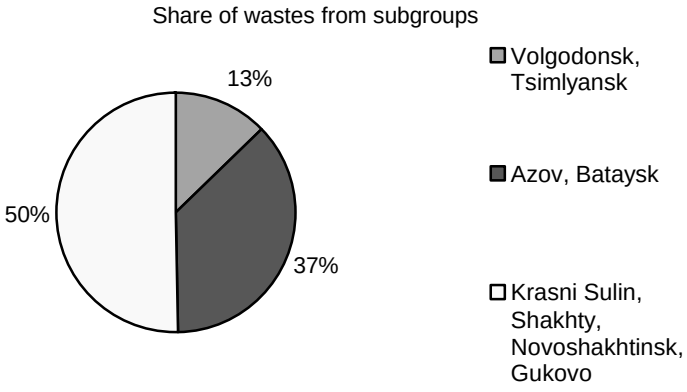
Source: Assumptions made in scenario

Table 5.2 The wastes generation distribution under inter-municipal cooperation. Deadlines for commissioning of new waste disposal facilities and their parameters

Municipality	Volgodonsk	Tsimlyansk	Azov	Bataysk	Krasny Soulin	Shakhty	Novoshakhtinsk	Goukovo
Share of the city in total MW generation in Group 2, %	11%	2%	25%	12%	16%	22%	6%	7%
Share of subgroup in total MW generation in Group 2, %	13%		37%		50%			
Year of the landfill's commissioning	2005		2004		2007			
Required capacity of the landfill, thousand tones	3 326		12 445		18 705			
Distance to the landfill, km	20	5	30	5	19	27	34	33
Weighted average distance to the landfill, km	18.0		21.9		26.1			

Source: Assumptions made in scenario

Figure 5.1 Shares of the subgroups in total waste generation in Group 2



Analysis of the collected data and the assumptions indicates that the introduction of inter-municipal cooperation, which implicates change of waste disposal facilities locations, will add 7 km to the weighted average distance for transportation of waste from the final collection point to the final disposal site (to a current average distance of 15 km, a default value used in the model). Extra costs for DSW transportation on this distance were included into the cost of collection and disposal of waste as «extra transportation costs».

5.2 Results of analysis for Group 2

The table below shows the distribution of municipal waste on disposal facilities in both scenarios, taking into account waste generation increase within 2001-2015.

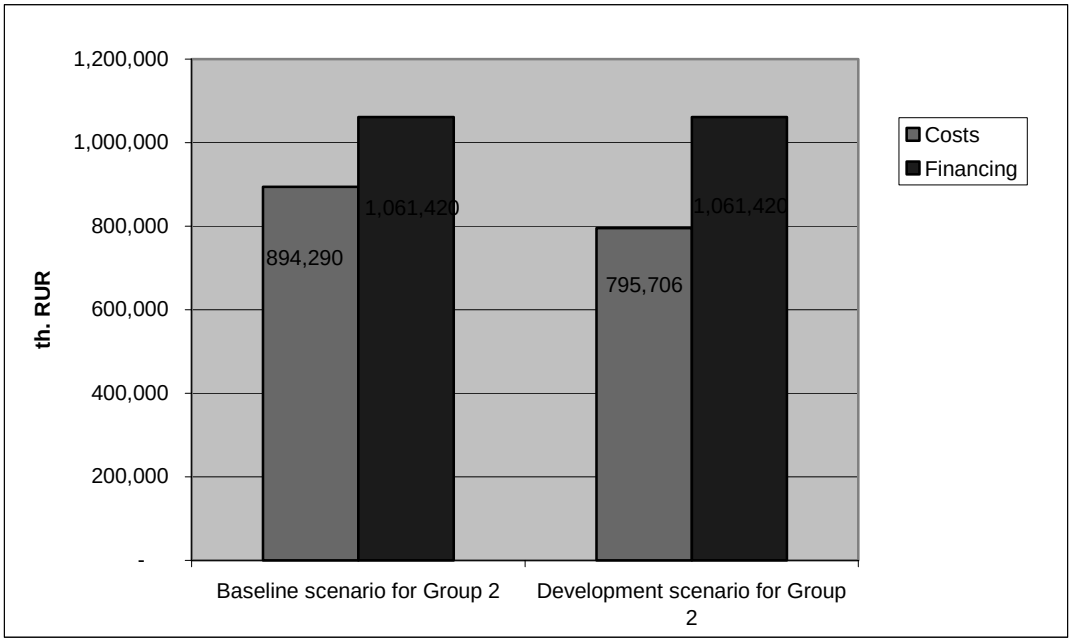
Table 5.3. Comparison of municipal wastes allocation onto disposal facilities in the Baseline Scenario and in the Inter-municipal Cooperation Development Scenario - for Group 2, tones

the Baseline Scenario for Group 2					**Inter-municipal Cooperation Development Scenario for Group 2**				
	2001	**2007**	**2010**	**2015**		**2001**	**2007**	**2010**	**2015**
Dumpsites	99,423	131,475	-	-	Dumpsites	99,423	-	-	-
Goukovo, landfill	10,395	-	-	-	Goukovo, landfill	2,647	-	-	-
Krasny Soulin, landfill	3,952	-	-	-	Krasny Soulin, landfill	1,006	-	-	-
Volgodonsk landfill	119,216	38,400	-	-	Volgodonsk landfill	30,363	-	-	-
Bataysk, landfill	94,118	30,316	44,881	57,032	Bataysk, landfill	201,914	152,206	172,624	219,360
Goukovo-new landfill	-	37,488	55,499	70,525					
Krasny Soulin – new landfill	-	83,579	123,734	157,233	Krasny Soulin – new landfill	-	251,966	285,767	363,134
Volgodonsk-new landfill	-	-	96,634	122,796	Volgodonsk-new landfill	-	43,023	48,795	62,005
Azov – new landfill	-	125,934	186,437	236,912					
Azov, landfill	11,068	-	-	-	Azov, landfill	2,818	-	-	-
Total				**644,500**					**644,500**

Source: Model calculations, assumptions of the Consultant

Modeling results for both scenarios for Group 2 indicate that the utilities' revenues, generated by services on removal and disposal of municipal waste within 2001-2015, will fully cover the expenditure needs, including expenditure on construction of new landfills (or new sections of the existing landfills).

Figure 5.2. Total expenditure needs and supply of finance in the Baseline Scenario and in the Inter-municipal Cooperation Development Scenario for Group 2 over 2001-2015



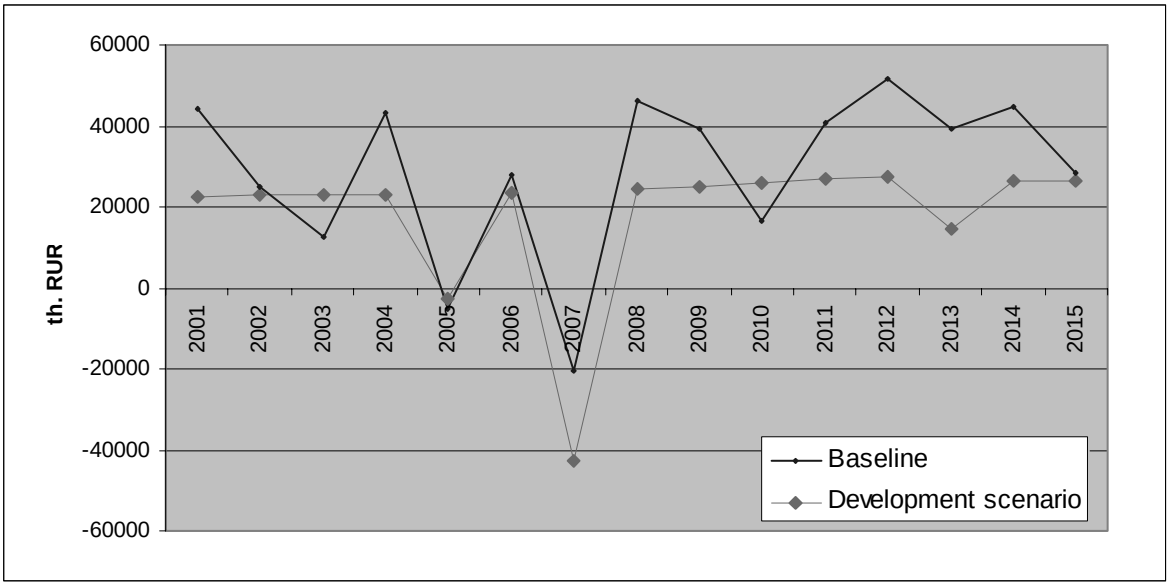
Source: Model calculations

Note that the expected overall surplus in Group2 does not mean that there will be a surplus in each city and each year. To assess what will be the situation with the revenue and expenditure streams over time in any specific city a more detail financial modeling is required at utility/city level.

As model calculations show, capital expenditure for the construction of new landfills (or extension of the existing ones) in the Baseline Scenario will amount to about 173 million RUR, and to 107 million RUR only in the Inter-municipal Cooperation Development Scenario. Therefore, stimulation of inter-municipal cooperation in construction and joint operation of MW landfills will allow saving some 66 million RUR (about more than $ 2.2 million) of oblast and local budgets' funds allocated for capital investments.

Annual financing gap/surplus for 2001-2015 is presented on the figure below.

Figure 5.3 Annual financing gap/surplus for 2001-2015 in the Baseline Scenario and in the Inter-municipal Cooperation Development Scenario for Group 2

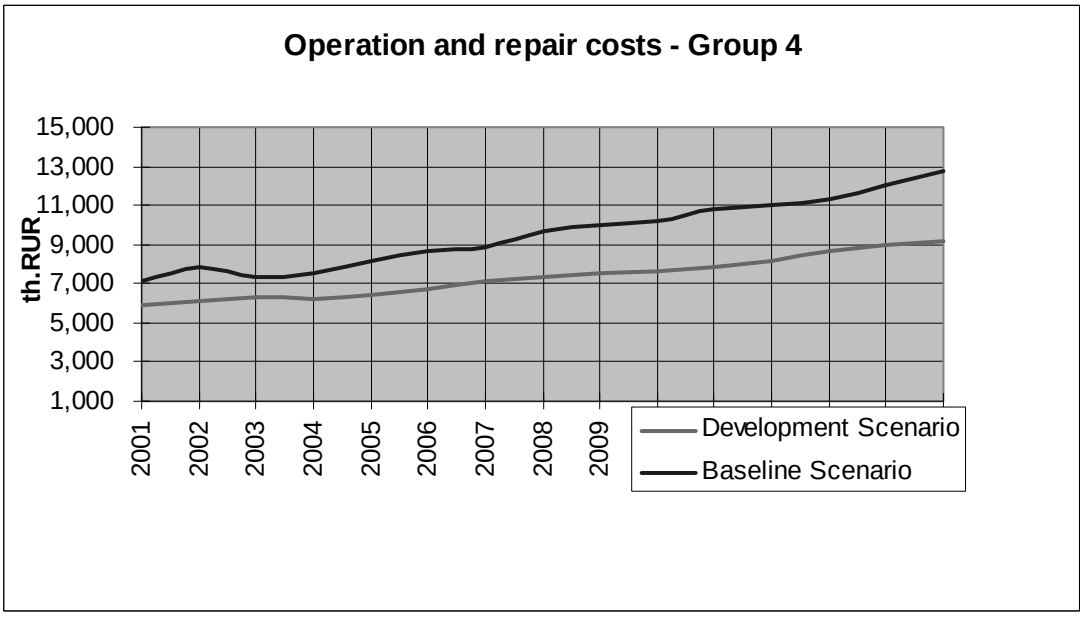


Source: Model calculations

The annual financing gap reaches the maximum, i.e. 22 million RUR in the Baseline Scenario and 45 million RUR in the Inter-municipal Cooperation Development Scenario, when capital investments reaches a peak (in 2003, 2005 and 2010 for the Baseline Scenario; in 2005 and 2007 for the Inter-municipal Cooperation Development Scenario). However, this gap could be financed, for instance from *borrowings,* including provision of interest-free loans from the oblast budget to the municipalities which undertake construction of the relevant waste disposal facilities. This is a quite realistic option, as surpluses observed in other years would provide necessary funds for repayment.

A rather unexpected outcome is that, In addition to saving on capital investment, the Inter-municipal Cooperation Development Scenario would also bring considerable saving on current expenditure (see figure below).

Figure 5.4. Current expenditure on MSW management in Group 2 over 2001-2015 - in the Baseline Scenario and in the Inter-municipal Cooperation Development Scenario



Source: Model calculations

Both scenarios demonstrate increase in expenditure needs for operation and maintenance, resulting from the fact that operation and maintenance of new landfills is more costly than operating the existing dumpsites. Current expenditure in the Inter-municipal Cooperation Development Scenario is lower than in the Baseline Scenario. This confirms that inter-municipal cooperation provides opportunities to optimize infrastructure and operations.

It has been assessed that the Inter-municipal Cooperation Development Scenario is less costly, due to waste disposal infrastructure optimization. Total savings on capital and current expenditure will amount to almost 100 million RUR over 2001-2015. The financial resources available for the industry would meet all necessary capital investments and maintenance expenditures, provided that all sources are mobilized as planned.

As soon as a surplus is expected, MW management and operating the MW landfills in some cities might be an attractive business for private companies under management contract or lease agreement.

E.g. the inter-municipal landfill could be leased by a private operator selected via tender, and lease revenues would be shared by municipalities proportionally to their investments in the landfill. The operator should be responsible for DW removal (from households) and transportation as well.

The economically justified tariffs for each consumer group should be approved by a commission created by the contributing municipalities. In order to stimulate construction of a landfill on a particular territory, the operator should be levied a land tax and environmental pollution charges in full, to feed the budget of municipality which hosts the landfill. These taxes and charges will be part of the operator’s costs, and will be covered by the tariff.

6 Conclusions and recommendations

6.1 Technical and economic issues

- In the cities of Rostov oblast, the development scenario, defined as the replacement of the existing dumpsites by DSW landfills complying with current Russian sanitary and environmental requirements, is both necessary and financially feasible.
- Opportunities of inter-municipal cooperation in Rostov oblast are limited, mainly because of geographic features (size of the oblast, water bodies, and road network topology). However, opportunities exist for some cities and should be grasped.
- Estimations made for other oblasts with similar geographic features (e.g. Novgorod oblast) indicate inexpediency of construction of oblast waste incineration plant, as capital cost, cost of waste processing at the incineration plant, as well as haulage costs for transportation of waste from other localities will be too high, which will generate a considerable increase of the tariff for waste removal.
- Additional arguments against construction of such plants are low population density, and the availability of sufficient number of sites for domestic waste disposal.
- Introduction of separate waste collection, together with the construction of experimental sorting stations, should be initiated in larger pilot cities, where volumes of recyclables would be enough to make the business commercially viable.

6.2 Financial issues

- In both scenarios, the total revenues that MW management utilities get from services on municipal waste removal and disposal, generally cover total expenditure needs related to this activity. Hence, this activity, when severed from other HCS, could be profitable and financially sustainable. Therefore, multipurpose HCS utilities cross-subsidize other communal services from revenues generated by domestic waste removal and disposal.
- In this case, separation of MW management into an individual business could make it financially attractive and create conditions for private sector and private investments involvement in the sector.
- *Therefore, MW sector in Rostov oblast could be commercially attractive for private business - there are good options for fair competition, which would facilitate performance improvement and optimization of current expenditure, as well as capital investments.*
- Operating profits earned from municipal wastes removal and disposal services make it possible to implement the proposed development scenarios, which *per se* are priority program of extension of the existing facilities and construction of new landfills.
- It is important that existing tariffs and the moderate increase proposed here are affordable for the overwhelming majority of households. On average the share of payments on wastes management services payments doesn't exceed 0.19% of average HH final consumption expenditure in Rostov oblast, which is more than affordable according to the most strict international standards (setting the affordability threshold at 0.7-1.7% of HH income).
- Under the assumptions related to increase of waste production, increase of tariffs in line with growth of GRP and households' incomes, and increase of payments collection from all consumers up to 95% and above, the existing funds are estimated to be enough for implementation of the considered MW management sector development scenarios.
- In spite of the absence of the financing gap for the whole period in question, *in certain years* a considerable financing gap of capital expenditure will be observed.

I.e. there is a problem of redistribution of financial resources upon time, which could be implemented through borrowings, including provision of interest-free loans from the oblast budget to the municipalities which undertake construction of the relevant waste disposal facilities.

- Analysis of the Inter-municipal Cooperation Development Scenario for Group 2 (recommended by the Working Group's members) indicates that inter-municipal cooperation in construction and joint operation of waste disposal facilities would sustain optimization of the infrastructure (reduction in the number of landfills) and generate a considerable decrease of the required capital investments, as well as in significant savings on current expenditure. This would allow saving of public money, and would have a favorable effect on the tariff for households.
- The inter-municipal landfills could be leased by private operators selected via tender, and lease revenues would be shared by municipalities proportionally to their contribution to capital investments. The operator should be responsible for DW removal (from households) and transportation as well. The economically justified tariffs for each consumer group should be approved by a commission created by the contributing municipalities. In order to stimulate construction of a landfill on a particular territory, the operator might be levied a land tax and environmental pollution charges in full, to feed the budget of municipality which hosts the landfill. These taxes and charges will be part of the operator’s costs, and will be covered by tariff.
- The construction of the sorting stations in pilot cities will require faster tariff growth at the first stage, but will generate revenues from sale of the recyclables later in the process.

7 References

1. COWI, 2004, The FEASIBLE Model, Version2, User Manual and Documentation, Ministry of Environment, Denmark /DANCEE, Copenhagen, 2001