Infrastructure Project Facility
Technical Assistance Window (IPF TA)
Western Balkans

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Sub project:
WB4-MNE-ENV-12B: Management Models and Options for Cost Recovery for the Future Construction and Operation of Regional Landfills in Montenegro

Tariff Models Report (Activity 4)

February 2013
The European Union's 2008 IPA Programme for Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Kosovo*, Turkey and Iceland

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Tariff Models Report (Activity 4)
Final
February 2013
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<thead>
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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>BOT</td>
<td>Build Operate Transfer</td>
</tr>
<tr>
<td>Budoš</td>
<td>Inter-municipal company established and designated to operate the regional landfill</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>EUR</td>
<td>Euro</td>
</tr>
<tr>
<td>IFIs</td>
<td>International Financing Institutions</td>
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<td>Infrastructure Projects Facility</td>
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<tr>
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<td>Montenegro</td>
</tr>
<tr>
<td>MONSTAT</td>
<td>Montenegro Statistics</td>
</tr>
<tr>
<td>NPV</td>
<td>Net present value</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operation and maintenance</td>
</tr>
<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
</tr>
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<td>PSB</td>
<td>Public sector benchmark</td>
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<td>PUC</td>
<td>Public Utility Company</td>
</tr>
<tr>
<td>SWM</td>
<td>Solid waste management</td>
</tr>
<tr>
<td>TPP</td>
<td>Thermal power plant</td>
</tr>
<tr>
<td>HH</td>
<td>Household</td>
</tr>
<tr>
<td>MSW</td>
<td>Municipal solid waste</td>
</tr>
<tr>
<td>CCT</td>
<td>Cost covering tariff</td>
</tr>
<tr>
<td>PBC</td>
<td>Performance based contract</td>
</tr>
<tr>
<td>PSP</td>
<td>Public sector participation</td>
</tr>
<tr>
<td>WtP</td>
<td>Willingness to pay</td>
</tr>
<tr>
<td>EBIT</td>
<td>Earnings before interest and taxes</td>
</tr>
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</table>
1 Executive Summary

This report constitutes the output of Activity 4 – “Review of tariff models and propose tariff models for the future operation of a regional landfill,” with the short title of “Tariff Models Report” – and entails a review of the current practice of tariffs in the waste management sector in Montenegro. The primary purpose of the report is two-fold: to demonstrate the local policy decisions that must be made in preparing solid waste management tariffs and to present a national solid waste tariff strategy.

To this end, the report examines possible tariff structures, including fixed-rate tariffs, as well as volume and weight-based variable tariffs. The report contains calculations of full-cost recovery and affordable tariffs for waste collection and landfill operations for three service areas:

- Nikšić, Plužine, and Šavnik Service Area – where a regional landfill is planned for construction (currently at design stage). This service area represents the largest municipality (after Podgorica) combined with two of the smallest municipalities in the country.

- Pljevlja and Žabljak Service Area – where a regional landfill is planned for construction (currently at feasibility study and design stage). This service area represents the northern region and a partially touristic area.

- Ulcinj and Bar Service Area – where a regional landfill has been opened for operations in June 2012. This service area represents a tourist area.

In this manner, the study includes service areas from three regions that are representative of Montenegro, including areas in which solid waste management is affected by tourism.

The report outlines the policy decisions that need to be made at the local level to introduce cost-recovery tariffs.

The report concludes with a strategy for implementation of tariff policy. This report is divided into eight chapters and includes four annexes.

Given the purpose of the report, it is also important to point out the limitations of the present study. Data on waste flows, investment costs, and operation and maintenance costs of current and future systems were estimated based on feas-

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bility studies (when available) as well as reports of municipalities and public utility companies (PUCs). Montenegrin PUCs are multi-purpose – in which solid waste management is just one of many activities – and separating out the costs and revenues that pertain only to solid waste management can be difficult. Additionally, in service areas without landfills (which describes most of the country), waste flows are a subject of large uncertainty. Therefore, the Consultant had to estimate data based on experience and data from similar studies and infrastructure. To that end, the solid waste management tariffs contained in this report should be considered as indicative tariffs, to be used for the purposes of analysing tariff policy and guiding the development of a tariff strategy.

The purpose of the Solid Waste Tariff Strategy is to provide a framework for the Government of Montenegro and municipalities for setting solid waste tariffs that are consistent with national policy documents (Revision of the National Solid Waste Master Plan, National Policy for Waste Management, etc) and national laws (Law on Waste Management). It is also intended to emphasise key principles in solid waste management that should govern the sector. For the Solid Waste Tariff Strategy, the following strategic objectives are recommended:

- **Objective 1:** Apply polluter pays and waste hierarchy principles in solid waste management (see Annex 3 Waste Hierarchy)

- **Objective 2:** Achieve financial sustainability in the provision of solid waste management services

- **Objective 3:** Implement local tariff policy that accounts for customer ability-to-pay for solid waste management services (affordability)

- **Objective 4:** Promote financial and managerial autonomy of solid waste service providers.

Within each of these strategic objectives, a set of measures and performance indicators are recommended to be implemented and track the progress of implementation, respectively.

The following tariff policy recommendations are offered in this report:

- Affordability limits (measured as 1% of average household disposable income) are likely to be exceeded during several years of the analysis. It is important that municipalities and PUCs advance to full-cost recovery tariffs and use policy means other than subsidies to PUCs to address affordability issues.

- Uniform SWM tariffs within particular customer groups should be preferred

- Revenue collection rates need to be brought up to a range of 90-95% on a consistent basis
• The tariff basis for household customers should be square meter (as is currently the case), number of registered persons, and number of households. Per container fees can be considered when customer databases have been updated and revenue collection rates reach 90-95% on a consistent basis.

• The tariff basis for non-household customers should be based on a per container fee.

• Customer databases require upgrading and updating, which can be done in parallel to other efforts to improve property registries, etc. Until such time as these databases are upgraded, more innovative tariff bases are not recommended.

• As an example of innovative tariff basis, the weight-based tariff is fair, encourages waste reduction (though illegal dumping needs to be policed), and complies with the polluter pays principle. It should not be considered, however, until revenue collection rates are consistently above 90-95%, when public awareness about SWM is raised, and when customers have viable options to reduce waste (composting, recycling, etc.)

• In tourist areas, tariffs should be collected year-round and the tariff rates should not differ from the tourist and non-tourist season. This enables the PUC to have a more predictable cash flow, as well as provides customers with a lower monthly payment (but paid throughout the year). On the other hand, this puts less pressure on municipalities and PUCs to track occupancies of vacation properties.
2 Purpose and Content of Report

Overall objectives

This report constitutes the output of Activity 4 – “Review of tariff models and propose tariff models for the future operation of a regional landfill,” with the short title of Tariff Models Report – and entails a review of the current practice of tariffs in the waste management sector in Montenegro. The primary purpose of the report is two-fold: to demonstrate the local policy decisions that must be made in preparing solid waste management tariffs and to present a national solid waste tariff strategy.

To this end, the report examines possible tariff structures, including fixed-rate tariffs, as well as volume and weight-based variable tariffs. The report contains calculations of full-cost recovery and affordable tariffs for waste collection and landfill operations for three service areas:

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In this manner, the study includes service areas from three regions that are representative of Montenegro, including areas in which solid waste management is affected by tourism.

The report outlines the policy decisions that need to be made at the local level to introduce cost-recovery tariffs.

The report concludes with a strategy for implementation of tariff policy. This report is divided into the following chapters:

Chapter 3 presents a brief review of the findings from the Activity 3 Report (Contract Options), with its basic conclusion that the private sector participation in the construction and operation of a landfill and treatment facilities can contribute to construction of a regional landfill and reducing operating costs. A
private entity, however, would likely identify a number of uncertainties and risks and expect a higher rate of return to be involved in the construction and operation of a regional landfill. The report concludes that a management contract for the operation of the regional landfill could be considered after a few years of operations when better data are available about waste flows, system operating costs, and the market for recyclables. Current uncertainties about investment costs and waste flows would prompt a private investor to seek a risk premium high enough to make it a more expensive option than operation by the publicly owned, albeit commercially oriented, company. Until then, a traditional approach, based on public sector investment and operation is warranted.

Chapter 4 reviews current practices in Montenegro in the area of tariffs for waste management. To that end, it reviews the current situation in three representative service areas.

Chapter 5 contains a qualitative review of various options for tariff-setting and structure. It reviews the advantages and disadvantages of flat-rate tariffs, variable-rate tariffs, as well as uniform and differentiated tariffs across customer types and parts of a service area. These tariff types and structures are evaluated according to compliance with various evaluation criteria, including: fairness, familiarity, transparency, linkage between costs and services, predictability of revenue, incentive for reducing waste, incentive to reduce illegal dumping, incentive to engage in recycling, ease of administration and enforcement.

Chapter 6 contains a quantitative review of selected tariff models from Chapter 5. For the three sample service areas, the main assumptions on input data are presented, followed by a comparison of the full-cost recovery tariffs with affordability constraints. The chapter ends with recommendations on future tariff structures.

Chapter 7 constitutes a “solid waste tariff strategy” in which a mission, vision, values and strategic objectives are proposed for improving tariff setting in Montenegro. Within each objective, a series of measures are recommended, for implementation that are designed to help achieve the given objective. For each objective, priorities are defined and performance indicators specified.

Chapter 8 presents the conclusions and recommendations.

In addition, there are four annexes, as follows: tariff models (Annex 1) presenting more detail on tariff models and principles of tariff-setting than contained in the main text; affordability (Annex 2) providing additional information on affordability thresholds for solid waste management; waste hierarchy (Annex 3) presenting the principle of waste hierarchy; and performance indicators (Annex 4) providing additional detail on performance indicators for consideration in the field of solid waste management.
3 Overview of Findings from Activity 3 Report

The Activity 3 Report – “Analyse the possible options for the construction and operation of landfills,” with the short title of Procurement Options Report – entailed an analysis of different options for the construction and operation of the proposed regional landfill for the Municipalities of Nikšić, Šavnik, and Plužine. The report concludes with a recommendation on the preferred method of construction and operation of the regional landfill. While this analysis is mainly specific to the case of the Nikšić regional landfill, it also contains implications for future regional landfills as well.

The report is divided into eight chapters and two annexes. These chapters cover the following issues:

• **Review of the local financial and institutional capacities of the main stakeholders in the Nikšić Service Area** – the three municipalities, the three public utility companies (PUCs), and the regional landfill company Budoš – to construct and operate a regional landfill, as well as to manage a contractual relationship with potential private sector participation. The conclusion of the review was that neither the municipalities, nor the PUCs are able to contribute financially in any meaningful amount to the construction of the regional landfill.

• **Overview of legal and institutional framework for landfill construction and operation.** The report considered four set-ups for construction and operation of the regional landfill: 1) Budoš acts as an inter-municipal company and represents the municipalities in relations with the PPP company; 2) the three municipalities deal directly with the PPP company; 3) the three municipalities deal with Budoš as an independent PPP company; 4) municipalities undertake waste operations themselves, as an own operation, utilising the existing PUCs (so-called public service benchmarking). The advantages and disadvantages of each approach were discussed. The chapter offers recommendations in the area of the legal framework in support of PPP, contract management, institutional coordination, and regulatory authorities, delegation and responsibilities. In particular, in the area of contract management the report recommended that a learning period be applied based upon performance and management contracts. The enables all contract parties to gain valuable knowledge and understanding of the needs for contract management based upon performance and management standards.
Introduction of the risk into analysis of the construction and operation of a regional landfill. In summary, the five steps of risk analysis in the consideration of PPPs were presented and discussed, including 1) development of a global risk matrix (constituting a long list of potential risks); 2) assigning qualitative probabilities of occurrence and magnitude of impact to the individual risk components that comprise the global risk matrix; 3) preparing a risk impact chart, in which it is determined which risks need to be mitigated, monitored, or controlled, as well as those that can be ignored; 4) preparing a reduced risk matrix, in which the main elements of risk (those that most need to be addressed due to their high probability of occurrence and/or high impact if they do occur); 5) prepare reduced risk matrix with quantitative estimates of probability of occurrence and expected impact for each risk element. This approach was applied to the case of the Nikšić regional landfill project for the baseline case (public construction and operation of landfill).

Review of available models for landfill construction and management. This chapter included an examination of models for landfill construction and management and in particular explores the main PPP models and characteristics. The chapter reviews the reduced risk matrix and quantitative probabilities and impacts were assigned to each risk element. Finally, the chapter concludes with a comparison of the public sector benchmark (PSB), which is the traditional method of procuring the construction and operation of a landfill (that is, fully within the government structure), a build-operate-transfer arrangement in which a private company constructs and operates the landfill and then transfers ownership to the municipality after a pre-defined period and an operating contract arrangement, in which a private party is not involved in the construction and ownership of the landfill, but operates it on behalf of the public authority. The chapter concluded with a summary comparison of the three modalities selected for analysis – the public sector benchmark (PSB), a build-operate-transfer arrangement and an operating contract arrangement – in terms of net present value (NPV) in EUR per tonne of accepted waste at the Nikšić landfill. These figures are used as relative magnitudes in order to determine which modality is worth exploring further. The results are depicted in the following table.

<table>
<thead>
<tr>
<th>NPVs (mln EURO)</th>
<th>PSB, traditional method</th>
<th>BOT</th>
<th>Operating Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Cash-outflow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction Period Costs – Nominal</td>
<td>5.8</td>
<td>5.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Operating period O&amp;M Costs – Nominal</td>
<td>61.1</td>
<td>61.1</td>
<td>61.1</td>
</tr>
<tr>
<td>Recycling revenues</td>
<td>-24.5</td>
<td>-24.5</td>
<td>-24.5</td>
</tr>
</tbody>
</table>
As illustrated above, the report found that the calculated net present value (NPV) per tonne of waste accepted to the Nikšić regional landfill is an important indicator of benefits offered by PPP options compared to the traditional public sector procurement method. This indicator is an aggregate figure, reflecting the cost of each option to the public budget in terms of money paid out (cash outflows) per tonne of waste going to the landfill.

In other words, for each option the NPV/tonne indicator shows what the public authority receives in terms of services in exchange for each EUR paid. Assuming that services received are equivalent in each option, the lower NPV in a PPP option would indicate a better Value for Money. Further, the extent of quantitative difference in NPV between PSB and PPP options would also communicate the extent of efficiency of private management of the contract as compared to public management of the contract. Such efficiency can be the result of various elements:

- better cost management by private operator
- better risk allocation and risk mitigation by private operator
- higher efficiency in facility operation.

Having understood the implications of the NPV/tonne figure, the results presented in the foregoing table can now be analysed:

- The baseline project costs and recycling revenues are the same for all three options.
- The construction period quantification of risks suggests that the lowest cost impact is expected in the BOT scenario - that is, when an experienced PPP contractor is chosen to construct the facility (along with later operation). This allows to minimise cost implications during construction due to the PPP operator’s capacity for better management and to mitigate risks.
- In terms of the impact of the operating period risk on the costs, both PPP options imply higher costs than that of the traditional procurement method.
A detailed analysis of individual risk elements suggests that this is a cumulative effect comprising two parts:

- Risk-adjustment cost reduction due to ability of PPP operator better to mitigate some of the operating period costs that are under its control, and

- Risk-adjustment cost increase due to PPP operator factoring significant uncertainties on the markets and revenues into its future O&M price to Public Authority

- The net result of these two parts is that the factoring in of uncertainties outweighs the cost-efficiency of a private operator; hence, the total trend is higher risk-adjusted costs.

- As a result, the NPV per tonne for all three options analysed are on approximately the same level, with the PPP options running slightly higher. Hence, the NPV/tonne of waste accepted at the landfill is slightly higher for the Operating Contract, due to the inability of the Operating Contract PPP counterpart to minimise the cost implications of construction period risks.

The analysis suggests a rather interesting, but logical case:

- Despite the fact that PPP options offer valuable construction and operating period cost reduction as a result of operating efficiency and better risk management, such positive gains are entirely outweighed by high risks associated with waste availability, quantity, and generated revenues (both from the gate fees and from recyclables).

- More complex PPPs, such as BOT can be used in the case of the Nikšić regional landfill, since the net effects are relatively even in comparison with traditional procurement method.

- A more gradual approach is recommended, however, since it can deliver substantially better value for money. Such an approach, as already mentioned above, can be implemented in the following steps:

  - Public Authority (with national and international contributions) constructs the landfill using the traditional procurement method

  - A simplified form of PPP Operating Contract (Service Contract) for a short period (3-5 years) is tendered with the objective to kick-start the operation of landfill facilities, in the process of which, to eliminate the main uncertainties related to the quality of construction work, actual waste amounts, market for recyclables, realistic operating costs, etc.

  - Once such uncertainties have been eliminated after 3-5 years of the Service Contract, s longer period Operating Contract (with no investment obligations for further cell construction or renewal of assets), or
a more complex Concession Contract (with investment obligations) can be contracted.

The value proposition of such a step-by-step approach is once the key market and revenue uncertainties are eliminated that the PPP operators will not attach such high premiums to the main elements of risk. Hence, the Public Authority will be able to take full advantage of the operational efficiencies of the private sector in the form of lower price of good quality services.

In conclusion, the Activity 3 Report recommended that the approach is first to consider the gradual introduction of a private sector operator (which could also be Budoš) by first tendering a management contract for the first 3-5 years of the landfill operations. After that, a long-term operating contract should be tendered. This approach enables the public sector (municipalities) to tender a known quantity – a landfill operation with few uncertainties surrounding in particular the amount of waste delivered to the landfill and the size of the recycling market.
4 Current Practice of Tariffs in Waste Management Sector in Montenegro

This chapter contains a review of the current practice of the tariffs in waste management sector in Montenegro. The following examples are reviewed:

- Nikšić, Plužine, and Šavnik Service Area – where a regional landfill is planned for construction (currently at design stage). This service area represents the largest municipality (after Podgorica) combined with two of the smallest municipalities in the country.

- Pljevlja and Žabljak Service Area – where a regional landfill is planned for construction (currently at feasibility study and design stage). This service area represents the northern region and a partially touristic area.

- Ulcinj and Bar Service Area – where a regional landfill has been opened for operations in June 2012. This service area represents a tourist area.

In addition, the tariff structures in Podgorica Municipality for the new landfill operations are reviewed as well.

According to Montenegrin law, municipalities are responsible for providing utility services – including collection and disposal of solid waste – and this responsibility has been delegated to multi-purpose utility companies in each municipality investigated in this report. In addition, regional landfill companies have been established to operate and manage existing and future landfills.

4.1 Podgorica

Solid waste management in Podgorica is provided by two companies: the public company “Cistoca” that collects and transports the waste to the landfill and the limited liability company “Deponija Livade” that operates the landfill. Cistoca charges for waste collection according to a tariff schedule from 2007, according to which households pay 0.03 EUR/m² per month for services. The tariff schedule contains rates for 13 other customer categories, ranging from 0.06 EUR/m² per month for education, culture, and sports institutions to 0.33 EUR/m² for market stalls in one region of the city. In addition, some of the customer categories involve flat monthly fees, such as for kiosks (18.90 EUR/month), clean-up after demonstrations (250 EUR), etc. The price does not include waste disposal. Deponija Livade is in charge of waste disposal and
charges 26 EUR/tonne. PC Cistoca pays this price for disposal of waste. In 2011, 61,000 tonnes of waste were disposed of at the landfill.

### 4.2 Nikšić, Plužine, and Šavnik service area

A regional landfill is proposed for the service area that comprises the municipalities of Nikšić, Plužine, and Šavnik. The landfill is in the project preparation stage. A landfill operating company – Budoš – has been established and, as the landfill is not yet constructed, currently employs one person.

#### 4.2.1 Service area

The three municipalities in the service area lie in north-central Montenegro. The Municipality of Nikšić is the largest Montenegrin municipality in terms of surface area (2,065 km²) and has 72,443 inhabitants in 21,683 households (according to the latest census from 2011). Approximately 80% of the population live in the city itself, with the balance located in rural areas of the municipality. The Municipality of Plužine covers a territory of 858 km². According to the 2011 Census, 3,246 citizens live in Plužine, with the majority living in the relatively lowland area of the municipality. Only 40% of the population live in the main town, whilst the balance lives in the rural areas. The Municipality of Šavnik covers an area of 553 km² and is home to 2,070 persons. Only 22% of the population live in the main town, with the balance living in the rural areas of the municipality.

#### Table 2 Population census results for Nikšić, Plužine and Šavnik (2003, 2011)

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Population census results for 2003</th>
<th>Population census results for 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Urban</td>
</tr>
<tr>
<td>Nikšić</td>
<td>75,282</td>
<td>58,212</td>
</tr>
<tr>
<td>Plužine</td>
<td>4,272</td>
<td>1,494</td>
</tr>
<tr>
<td>Šavnik</td>
<td>2,947</td>
<td>570</td>
</tr>
<tr>
<td>Total</td>
<td>82,501</td>
<td>60,276</td>
</tr>
</tbody>
</table>


Nikšić, the second largest city in Montenegro after Podgorica, is also a key industrial centre with a steel mill and brewery of national significance. Šavnik Municipality has the smallest population in the country and its economy is based on agriculture and services. Plužine contains the Mratinje Dam and Pliva Lake, which attracts some hiking and boating tourism.
4.2.2 Impact of tourism of solid waste generation

The impact of tourism on the generation of municipal solid waste has been estimated based on the number of tourist days\textsuperscript{1}. Nikšić was assumed to have 23,050 tourist-days per year with a 0.17\% impact on solid waste generation. Plužine was assumed to have 2,192 tourist-days per year with an overall impact on solid waste generation of 0.29\%, finally, Šavnik with 3,640 tourist days per year, which was assumed to have an impact of 0.70\% on municipal solid waste generation. The report concluded that these municipalities are not affected by tourism.

4.2.3 Current waste management practices

As currently there is no regional landfill in place, the municipalities collect waste and deposit it without treatment in municipal dumps. Solid waste services in each municipality are provided by a multi-purpose PUC that covers all kinds of municipal services (such as solid waste, street cleaning, road maintenance, green space management, snow removal, markets, funerals, etc.). In addition, the company in Plužine covers housing and the PUC in Šavnik covers wastewater. In each case, the respective municipality founded the PUC. The basic data on waste services are provided in the following table.

\textit{Table 3} Basic data on solid waste services, 2012

<table>
<thead>
<tr>
<th>Category</th>
<th>Nikšić</th>
<th>Plužine</th>
<th>Šavnik</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of employees engaged in solid waste management</td>
<td>49, of which 18 fixed-term contract</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Number of customers</td>
<td>1,014 corporate and 14,393 households</td>
<td>415 corporate and 46 households</td>
<td>No data</td>
</tr>
<tr>
<td>Number of waste containers</td>
<td>400 of 1.1 m(^3); 70 of 5 m(^3)</td>
<td>12 containers for selective waste collection; 50 litre bins at 10 locations; 60 containers of 1.1 m(^3)</td>
<td>25 of 3 m(^3)</td>
</tr>
<tr>
<td>Number of waste trucks</td>
<td>5 loaders for the removal of 5 m(^3) containers (1984, 1986, 1987, 1990 and 1993)</td>
<td>1 compactor truck (to 15 m(^3)) – 4 years old</td>
<td>1 truck for carrying containers – 3 m(^3) containers</td>
</tr>
<tr>
<td></td>
<td>6 trucks for emptying 1.1 m(^3) containers (two-1985, two-1990; two 2004)</td>
<td>1 truck for carrying open containers – 3 m(^3) containers (35 years old)</td>
<td>1 truck for carrying containers – 3 m(^3) containers</td>
</tr>
<tr>
<td></td>
<td>One cleaner (1985)</td>
<td>Zastava truck 50.8/3 tons - extended cabin (30 years old)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>One cleaner (from 1985)</td>
<td></td>
</tr>
<tr>
<td>Waste collected, t/year</td>
<td>42,000</td>
<td>727</td>
<td>No data</td>
</tr>
<tr>
<td>Revenue collection rate (2011)</td>
<td>64.58% from HHs 83.96% from others</td>
<td>48.77% from HHs 51.23% from others</td>
<td>No data</td>
</tr>
</tbody>
</table>

Source: PUCs

\textsuperscript{1} Strategy for the Implementation of the Solid Waste Management Master Plan in Montenegro, Egis BCEOM Int., 2009.
General assumptions

In order to fill the gaps in available data, the following assumptions have been made:

- The population and waste flow forecasts were mainly taken from the Feasibility Study for Nikšić Solid Waste Landfill, 2008 and the Strategic Master Plan for Solid Waste Management (2004/2005); these data were then adjusted based on the new census data in 2011. Additional information is provided in the Activity 2 Report of this project.

- Waste collection ratios of the Municipalities are calculated as 83% of their total population, based on the forecasted total amount of collected waste by the PUCs and waste generation rate per household proposed in the Strategic Master Plan for Solid Waste Management and the Revision of the National Solid Waste Master Plan.

- Unit waste generation rates from the urban and rural areas are taken as equal, in compliance with the Strategic Master Plan for Solid Waste Management and Revision of the National Solid Waste Master Plan.

- It is assumed that 95% of the waste generation in urban areas come from households, while this ratio is assumed as 98% for rural areas, based on the statistical data obtained from MONSTAT.

- Unless information from PUCs on the average age of the existing assets was available, it is assumed that assets are fully depreciated and are to be replaced as soon as possible.

4.2.4 Costs of solid waste collection

The current costs of solid waste collection are discussed below. The data collected from the individual PUCs on operating costs and revenues were not fully representative of the actual financial situation of waste collection activities. Apart from the Nikšić PUC, all budget information covers the overall PUC activities for green areas, street cleaning, cemeteries, etc. Therefore, based on verbal communication and/or written information, some assumptions were made to estimate the share of waste collection in the total costs and revenues of the overall services of each PUC.

Cost assumptions

Thus, the following assumptions are made:

- No maintenance cost is foreseen for civil works

- Maintenance costs for vehicles are assumed as 5% of the purchase cost

- 10% of the total cost is added for miscellaneous expenses (except Nikšić, where the costs were sufficiently detailed)

- 21% of the total salary cost provided in the 2010 budget is assumed to be spent for waste collection services for Plužine (5 employees out of 24) and
20% for Šavnik, respectively. The amount for Šavnik is assumed based on the percentage from Plužine, as data from Šavnik were available only as a total amount and not separated out for solid waste collection.

- 80% of the fuel and energy costs and 30% of the raw materials costs in the total budget of the PUCs are considered related to waste activities.

- Depreciation costs are ignored (even if they were included in the PUC budget) and calculated separately based on the provided assets list.

- Financial costs are ignored due to insufficient information on the terms and conditions of the existing loans.

O&M Costs

Table 4 provides the estimated O&M costs in Nikšić, Plužine and Šavnik for waste collection in 2012 based on the above assumptions.

<table>
<thead>
<tr>
<th>Cost items</th>
<th>Nikšić</th>
<th>Plužine</th>
<th>Šavnik</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed O&amp;M costs</td>
<td>1,043,562</td>
<td>54,489</td>
<td>38,313</td>
</tr>
<tr>
<td>Salaries</td>
<td>844,381</td>
<td>36,035</td>
<td>32,580</td>
</tr>
<tr>
<td>Maintenance, civil works</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maintenance, vehicles</td>
<td>49,000</td>
<td>13,500</td>
<td>2,250</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>150,181</td>
<td>4,954</td>
<td>3,483</td>
</tr>
<tr>
<td>Variable O&amp;M costs</td>
<td>454,612</td>
<td>106,690</td>
<td>36,344</td>
</tr>
<tr>
<td>Fuel/Power</td>
<td>250,049</td>
<td>89,677</td>
<td>30,549</td>
</tr>
<tr>
<td>Raw materials</td>
<td>54,383</td>
<td>7,314</td>
<td>2,491</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>150,181</td>
<td>9,699</td>
<td>3,304</td>
</tr>
</tbody>
</table>

Source: Consultants estimation based on collected data from PUCs.

4.2.5 Tariffs

In Nikšić, the basis for determining the cost of collection, transport and waste disposal to the landfill from legal entities and households, is as follows:

- Cost of services: cover gross wages and benefits, other personal income; fuel and lubricants; electricity; water; spare parts and tires; service and maintenance; insurance and vehicle registration; safety.
- General costs: cover administration and management; other expenses (office supplies, postal services, audits, technical literature, advertising, etc.).
- Depreciation
- Financing costs - cover interest on loans for fixed assets.

2 From the document: Calculation of monthly costs for collection, transport, and disposal of communal solid waste (Kalkulacija mjesečnih troškova za sabiranje komunalnog otpada, odvoza i deponovanja), Nikšić.
The current solid waste tariffs in the three municipalities are given in Table 5.

**Table 5**  
*Current solid waste collection tariffs, by municipality, 2012*

<table>
<thead>
<tr>
<th>Category</th>
<th>Nikšić</th>
<th>Plužine</th>
<th>Šavnik</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household, with VAT</td>
<td>City 0.071 EUR/m² (8.50 EUR/tonne)</td>
<td>0.072 EUR/m² (12.58 EUR/tonne)</td>
<td>0.03 EUR/m² (7.01 EUR/tonne)</td>
</tr>
<tr>
<td></td>
<td>Suburb 0.060 EUR/m² (7.19 EUR/tonne)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal entities (public and private), with VAT</td>
<td>0.004 – 0.321 EUR/m² (0.02-1.28 EUR/tonne)</td>
<td>0.022–0.40 EUR/m² (0.08-1.43 EUR/tonne)</td>
<td>0.03-0.3 EUR/m² (0.60-6.00 EUR/tonne)</td>
</tr>
</tbody>
</table>

Source: PUCs and Consultant estimates (for equivalent per tonne tariffs based on estimated waste generation)

The solid waste revenues of all Nikšić municipalities are sufficient to cover only operation costs (excluding depreciation). The revenue figures obtained from Plužine and Šavnik municipalities are insufficiently detailed to calculate the average annual household payment for solid waste services. In both municipalities, the total solid waste revenues are almost sufficient to cover operation costs (excluding depreciation). The figures of Nikšić indicate, however, that average annual household tariff for solid waste is 23 EUR per household per year.

### 4.2.6 Proposed investment

Based on data reported in the Activity 3 Report (Procurement Options Report), the proposed regional landfill is expected to operate for a period of 20 years. The landfill capacity for the first stage of operations (12 years) is 319,053 cubic metres, with a bottom surface area of 23,000 square metres. The second stage has a capacity of 197,684 cubic metres (for a total of 516,737 m³) and the landfill body area is 14,000 square meters (for a total of 37,000 m²).

**Investment cost**  
Based on data reported in the Activity 3 Report (Procurement Options Report), the investment costs for the landfill, Phase I, and were assumed to be just over 14 million EUR, including 1.5 million EUR for supervision. The Phase II costs are 4.2 million EUR (454 thousand EUR for supervision). A recycling centre is also included in these investment costs.

**Operating costs**  
Operating costs were estimated based on the feasibility study for construction of the regional landfill, as well as on changes in the costs of key inputs since the study was completed, in particular salaries and fuel costs. Total annual operating and maintenance costs were estimated at approximately 533,000 EUR (including aftercare costs, annual monitoring, etc.) for the landfill and all facilities (sorting facility). This is a higher figure than in the feasibility study prepared for the regional landfill due to changes in the average wages in Montenegro and assumptions on maintenance. The operating costs also include those of the recycling centre.
4.2.7 Affordability

Affordable tariffs for solid waste management were estimated for urban and rural areas, as well as for the average over the entire service area. This was done by assuming that households can spend no more than 1% of their disposal income on solid waste management services. Accordingly, the affordability rates for the service area were assumed for 2012 as follows:

- Urban areas: 6.82 EUR/household/month, including VAT
- Rural areas: 4.48 EUR/household/month, including VAT
- Average for the service area: 6.28 EUR/household/month, including VAT.

4.3 Pljevlja and Žabljak service area

The service area for the proposed regional landfill comprises the municipalities of Pljevlja and Žabljak. The municipalities lie in north-northeast Montenegro within the Durmitor Region.

4.3.1 Service area

Pljevlja

The Municipality of Pljevlja is the third largest by area in Montenegro, after Nikšić and Podgorica. The municipality has a population of 31,060, of which 19,622 are urban and 11,438 rural (2011 Census). Pljevlja Municipality is the third largest municipality in Montenegro and one of the country’s main economic engines. The coal mine in Pljevlja employs about 1,800 persons. The 210 MW thermal power plant (TPP) Pljevlja provides around 40% of the electric power supply of Montenegro. There are more than 300 private companies in Pljevlja, dealing with all types of business from production, civil engineering, and trade to services. The total number of employees in Pljevlja exceeds 6,500 across all economic sectors.

Žabljak

The Municipality Žabljak is located next to Durmitor Mountain. The municipality has a population of 3,599, of which 1,737 are urban and 1,862 rural (2011 Census). The municipality comprises 28 settlements, organised in 12 local communities, and one city. Žabljak is a well-known tourist centre and its development prospects are based on tourism, production of organic and healthy food and small industries.

Table 6 Population census results for Pljevlja and Žabljak (2003, 2011)

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Population census Results for 2003</th>
<th>Population census Results for 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Urban</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>22,806</td>
<td>21,741</td>
</tr>
<tr>
<td>Žabljak</td>
<td>4,204</td>
<td>1,937</td>
</tr>
<tr>
<td>Total</td>
<td>27,010</td>
<td>23,678</td>
</tr>
</tbody>
</table>

Source: Draft Feasibility Report of Construction of the Regional Centre for Waste Management for the Municipalities of Pljevlja and Žabljak, August 2012
4.3.2 Impact of tourism of solid waste generation

The impact of tourism on the generation of municipal solid waste has been estimated based on the number of tourist days. Pljevlja was assumed to have 27,900 tourist-days per year with a 0.43% impact on solid waste generation. In contrast, Žabljak was assumed to have 80,564 tourist-days per year with an overall impact on solid waste generation of 10.7%. Based on these assessments, the report concluded that generation of MSW in Žabljak is affected by tourism, but not in Pljevlja. Significantly, Žabljak is the only non-coastal municipality to be designated as affected by tourism.

4.3.3 Current waste management practices

Currently, municipal waste management is undertaken by municipally owned management companies, one in each municipality. These are: PUC Cistoca Pljevlja and PUC Žabljak. Both companies offer integrated communal services comprising street cleaning, solid waste collection and disposal, as well as maintenance of parks and cemeteries. The PUCs are founded by the respective municipalities and are 100% publicly owned. As currently there is no regional landfill in place, the municipalities collect waste and dump it without treatment in municipal dumps. The basic data on waste services are provided in the following table.

Table 7 Basic data on solid waste services, 2012

<table>
<thead>
<tr>
<th>Category</th>
<th>Pljevlja</th>
<th>Žabljak</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of employees engaged in solid waste management</td>
<td>58</td>
<td>5</td>
</tr>
<tr>
<td>Number of customers</td>
<td>6,200 households; 485 commercial; 72 public entities</td>
<td>1,058 households; 83 commercial; 27 public entities</td>
</tr>
<tr>
<td>Number of waste containers</td>
<td>450 of 1.1 m³; 60 of 5 m³; 2,000 of 0.80 m³</td>
<td>50 of 5 m³</td>
</tr>
<tr>
<td>Number of waste trucks</td>
<td>6 trucks (from 1995-2009); 2 trucks at dumpsite (1981 and 1984); 3 tractors (2004)</td>
<td>2 trucks (from 1979 and 1993); 1 tractor (1989)</td>
</tr>
<tr>
<td>Waste collected, t/year</td>
<td>10,399</td>
<td>3,634</td>
</tr>
<tr>
<td>Revenue collection rate</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Status of solid waste management plan</td>
<td>Developed under feasibility study</td>
<td>Developed under feasibility study</td>
</tr>
</tbody>
</table>

Source: Draft Feasibility Report of Construction of the Regional Centre for Waste Management for the Municipalities of Pljevlja and Žabljak, August 2012

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4 ibid.
4.3.4 Costs of solid waste collection

The current costs of solid waste collection are discussed below.

The background data for operating costs of Pljevlja and Žabljak are taken from the Draft Feasibility Study as waste collection expenses for 2011.

Cost assumptions

The following assumptions were made for the adjustment:

- Maintenance costs for vehicles are assumed as 5% of the purchase cost
- 10% of the total cost is added for miscellaneous
- Depreciation costs are ignored (even if they were included in the PUC budget) and calculated separately based on the provided assets list
- Financial costs are ignored due to insufficient information on the terms and conditions of the existing loans.

Table 8 provides estimated O&M costs for waste collection in 2012 based on the above assumptions.

<table>
<thead>
<tr>
<th>Cost items</th>
<th>Pljevlja</th>
<th>Žabljak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed O&amp;M costs</td>
<td>525,963</td>
<td>53,328</td>
</tr>
<tr>
<td>Salaries</td>
<td>426,648</td>
<td>36,480</td>
</tr>
<tr>
<td>Maintenance, civil works</td>
<td>12,000</td>
<td>2,500</td>
</tr>
<tr>
<td>Maintenance, vehicles</td>
<td>39,500</td>
<td>9,500</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>47,815</td>
<td>4,848</td>
</tr>
<tr>
<td>Variable O&amp;M costs</td>
<td>95,584</td>
<td>7,750</td>
</tr>
<tr>
<td>Fuel/Power</td>
<td>86,895</td>
<td>7,045</td>
</tr>
<tr>
<td>Raw materials</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>8,689</td>
<td>705</td>
</tr>
</tbody>
</table>

Source: Consultants estimation based on data from Draft Feasibility Report, August 2012

4.3.5 Tariffs

The current solid waste tariffs in the two municipalities in the service area are given in Table 9.

<table>
<thead>
<tr>
<th>Category</th>
<th>Pljevlja</th>
<th>Žabljak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households, with VAT</td>
<td>0.85 EUR/ m², up to 50 m²</td>
<td>0.10 EUR/ m²</td>
</tr>
<tr>
<td></td>
<td>0.78 EUR/ m², 50-80 m²</td>
<td>(30.63 EUR/tonne)</td>
</tr>
<tr>
<td></td>
<td>(13.50 EUR/tonne)</td>
<td>(30.63 EUR/tonne)</td>
</tr>
<tr>
<td></td>
<td>0.68 EUR/ m², above 80 m²</td>
<td></td>
</tr>
<tr>
<td>Legal entities (public and private), with VAT</td>
<td>0.85 EUR/ m², up to 50 m²</td>
<td>0.52 EUR/ m²</td>
</tr>
<tr>
<td></td>
<td>0.78 EUR/ m², 50-80 m²</td>
<td>(16.32 EUR/tonne)</td>
</tr>
<tr>
<td></td>
<td>(6.59 EUR/tonne)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.68 EUR/ m², above 80 m²</td>
<td></td>
</tr>
</tbody>
</table>

Source: PUCs and Consultant estimates (for equivalent per tonne tariffs based on estimated waste generation)
The solid waste revenues of both municipalities are sufficient to cover operation costs. The annual revenues exceed costs by 28% in Pljevlja while revenues are 3.7 times of the costs in Žabljak. That means the solid waste revenues are used to finance other services of the PUC. The revenue figures obtained from Žabljak municipality are not detailed enough and do not allow to calculate average annual household payment for solid waste services. The figures of Pljevlja indicate, however, that average annual household tariff for solid waste is 56 EUR per household per year.

4.3.6 Proposed investment
The investment costs for the landfill, Phase I, were assumed to be just over 7.6 million EUR, including supervision, training and contingencies.

Operating costs
Based on the draft feasibility study for construction of the regional centre for waste management for the municipalities of Pljevlja and Žabljak, total annual operating and maintenance costs were estimated at approximately 363,000 EUR (including aftercare costs, annual monitoring, etc.) for the landfill and all facilities.

4.3.7 Affordability
Affordable tariffs have been estimated assuming that households can spend no more than 1% of their disposal income on solid waste management services. In the feasibility study for the construction of a regional landfill in the service area\(^5\), the affordability rates for the service area were assumed based on data on Pljevlja Municipality. Accordingly, it was found that average annual household spending on MSW stands at 56 EUR, which corresponds to 4.66 EUR/month and 0.6% of disposable income. Assuming 1% affordability limit, an average household could spend 94 EUR per annum on solid waste services in 2016 based on a 682 EUR income assumption, which means households can afford to pay 38 EUR (including VAT) per annum in addition for the disposal of wastes.

4.4 Bar and Ulcinj service area
The service area for the existing regional landfill (as of June 2012) comprises the municipalities of Bar and Ulcinj. The municipalities lie on the south-eastern part of the Adriatic Coast of Montenegro.

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4.4.1 Service area

The Municipality of Bar has a population of 42,048 (2011 Census), with an increase from 39,539 at the 2003 Census. Ulcinj Municipality, on the other hand, has a population of 19,921 (2011 Census), with a decrease from 2003 population which was 20,076. The breakdown of urban and rural population is shown in Table 10.

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Population census results for 2003</th>
<th>Population census results for 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Urban</td>
</tr>
<tr>
<td>Bar</td>
<td>40,032</td>
<td>17,742</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>20,290</td>
<td>10,828</td>
</tr>
<tr>
<td>Total</td>
<td>60,322</td>
<td>28,570</td>
</tr>
</tbody>
</table>


4.4.2 Impact of tourism of solid waste generation

The impact of tourism on the generation of municipal solid waste has been estimated based on the number of tourist days. Ulcinj was assumed to have 1.38 million tourist-days per year with a 37.22% impact on solid waste generation. Generation of MSW in Bar is also affected by tourism, it was assumed to have 2.34 million tourist-days per year with an overall impact on solid waste generation of 30.09%. Based on these assessments, the report concluded that generation of MSW in both municipalities is affected by tourism.

4.4.3 Current waste management practices

Currently, municipal waste management is undertaken by three different municipally owned management companies, one in each municipality for waste collection and one for regional landfill operation. Both companies for waste collection offer integrated communal services comprising street cleaning, solid waste collection and disposal, as well as maintenance of parks and cemeteries. The PUCs are founded by the respective municipalities and are 100% publicly owned. The regional landfill Možura began operations in June 2012; before that, the municipalities collected waste and dumped it without treatment in municipal dumps. Table 11 shows the disposed waste amounts to the new landfill for a three-month period.

---

The basic data on waste services are provided in Table 12.

**Table 11** Quantity of waste deposited at the sanitary landfill Možura, tonne

<table>
<thead>
<tr>
<th>Month</th>
<th>PUC in Bar</th>
<th>PUC in Ulcinj</th>
<th>Public Utility and Housing Enterprise Budva</th>
<th>Hemosan (commercial company in Bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August</td>
<td>2,644</td>
<td>1,575</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>September</td>
<td>1,695</td>
<td>788</td>
<td>2,164</td>
<td>17</td>
</tr>
<tr>
<td>October</td>
<td>1,418</td>
<td>559</td>
<td>1,228</td>
<td>27</td>
</tr>
</tbody>
</table>

Source: PUC for landfill operation

The basic data on waste services are provided in Table 12.

**Table 12** Basic data on solid waste services for Bar and Ulcinj, 2012

<table>
<thead>
<tr>
<th>Category</th>
<th>Bar</th>
<th>Ulcinj</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of employees engaged in solid waste management</td>
<td>62 (12 white collar, 48 blue collar)</td>
<td>No data.</td>
</tr>
<tr>
<td>Number of waste containers</td>
<td>600 of 1.1 m$^3$; 90 open containers of 4-7 m$^3$; 30 of 0.9 m$^3$; 100 selective containers for paper, glass and plastics</td>
<td>2,000 waste bins of 80 l; 170 of 1.1 m$^3$; 20 skip containers of 5-7 m$^3$</td>
</tr>
<tr>
<td>Number of waste trucks for waste collection</td>
<td>8 trucks for emptying containers (capacities from 13 - 22 m$^3$) 8 trucks for skip containers</td>
<td>5 trucks for emptying 1.1 m$^3$ containers 1 excavator</td>
</tr>
<tr>
<td>Number of vehicles and equipment’s at landfill</td>
<td>11 Compactor 1 Bulldozer 1 Combined backhoe/loader 1 Tractor trailer and tanker 1 Mobile pump 1 Infrared gas analyser</td>
<td></td>
</tr>
<tr>
<td>Waste collected, t/year</td>
<td>25,000</td>
<td>3,584 (deposited in Mozura total for July, August, September and October) corresponds approximately to 12,300</td>
</tr>
<tr>
<td>Revenue collection rate</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Status of solid waste management plan</td>
<td>Ready but not approved yet</td>
<td>No data</td>
</tr>
</tbody>
</table>

Source: PUCs and data from Baseline Report of Strategic Master Plan for Solid Waste Management for existing assets of Ulcinj Municipality

**4.4.4 Costs of solid waste collection**

The current costs of solid waste collection are discussed below. Very little data on the operating costs and revenues were collected from Bar Municipality (fuel costs, depreciation, financial and other costs) and no data were provided by Ulcinj Municipality.

Cost assumptions Therefore, the following assumptions are made:
- Salary cost of Bar PUC is calculated based on the number of employees and estimated average net salaries (663 EUR/month for white collar, 392 EUR/month for blue collar)

- Salary cost of Ulcinj PUC is estimated 80% of the Bar PUC salary cost

- Fuel cost of Ulcinj PUC is calculated based on Bar PUC fuel cost as a ratio of collected waste amounts

- No maintenance cost is foreseen for civil works

- Maintenance costs for vehicles are assumed as 5% of the purchasing cost

- 10% of the total cost is added for miscellaneous expenses

- Depreciation costs are ignored (even if they were included in the PUC budget) and calculated separately based on the provided assets list

- Financial costs are ignored due to insufficient information on the terms and conditions of the existing loans.

Table 13 presents the estimated O&M costs for waste collection in 2012 based on the above assumptions.

```
<table>
<thead>
<tr>
<th>Cost items</th>
<th>Bar</th>
<th>Ulcinj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed O&amp;M costs</td>
<td>441,317</td>
<td>321,484</td>
</tr>
<tr>
<td>Salaries</td>
<td>337,198</td>
<td>269,758</td>
</tr>
<tr>
<td>Maintenance, civil works</td>
<td>64,000</td>
<td>22,500</td>
</tr>
<tr>
<td>Maintenance, vehicles</td>
<td>40,120</td>
<td>29,226</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>23,705</td>
<td>12,143</td>
</tr>
<tr>
<td>Variable O&amp;M costs</td>
<td>260,753</td>
<td>133,569</td>
</tr>
<tr>
<td>Fuel/Power</td>
<td>237,048</td>
<td>121,426</td>
</tr>
<tr>
<td>Raw materials</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>23,705</td>
<td>12,143</td>
</tr>
</tbody>
</table>
```

Source: Consultants estimation based on collected data from PUCs.

### 4.4.5 Tariffs

The current solid waste tariffs in the two municipalities in the service area are as in the following table.
Table 14  Current solid waste collection tariffs, by municipality, 2012

<table>
<thead>
<tr>
<th>Category</th>
<th>Bar</th>
<th>Ulcinj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households, with VAT</td>
<td>0.1 EUR/ m² (13.60 EUR/tonne)</td>
<td>0.049 EUR/ m² for touristic season (7.19 EUR/tonne, based on 0.053 EUR/m² weighted average tariff)</td>
</tr>
<tr>
<td>Commercial and public institutions</td>
<td>0.1 EUR/ m² (1.80 EUR/tonne)</td>
<td>0.053 EUR/ m² (2.06 EUR/tonne)</td>
</tr>
</tbody>
</table>

Source: PUCs and Consultant estimates (for equivalent per tonne tariffs based on estimated waste generation)

The solid waste revenues of Bar municipality are sufficient to cover operation costs. The annual revenues exceed costs by 3.6 times. This means that the solid waste revenues are used to finance other services of the PUC. The revenue figures obtained from Ulcinj municipality were insufficiently detailed to calculate the average annual household payment for solid waste services. The figures of Bar indicate, however, that average annual household tariff for solid waste is 63 EUR per household per year.

4.4.6 Investment and operating costs

Since construction of the regional landfill of Možura was completed in June 2012, the investment costs for phase I of the landfill were added to the tariff model; this figure was over 6 million EUR. Detailed operating and maintenance costs were not made available to the Consultant and were therefore estimated at approximately 308,000 EUR (including aftercare costs, annual monitoring, etc.) for the landfill and all facilities.
5 Available Options for Tariff Setting

This chapter summarises the broader and more in-depth discussion from Annexes 1 and 2.

Types of tariffs

Municipalities can implement the following types of tariffs for solid waste services, comprising collection and treatment of waste:

- Flat-rate tariffs, based on unit figures for waste generation or other measures

- Variable-rate tariffs, including volume-based and weight-based tariffs.

Tariff Collection

In addition, municipalities need to consider various options for tariff collection given the need to adhere to the cost recovery and polluter pays principles and the fact that in the future they will be operating waste systems together with other municipalities. Thus, within a given solid waste service area, municipalities need to consider the following tariff collection options:

- Municipalities in service area collect tariffs through an existing fee collection mechanism (for example, in the property tax of the plot owner, or within the electricity, water supply, or sewer bill)

- Public utility company providing the waste management service collects tariffs through its own means or through a dedicated utility that collects tariffs from all utility services within the given municipality or service area

- Landfill management company (such as Budoš) collects that part of the tariff related to landfill operation and maintenance from public utility companies that collect tariffs for operating the waste collection system

- Private operator collects tariffs based on direct contracts with users.

The present chapter contains a qualitative analysis of the various tariff bases and collection methods.
5.1 Evaluation criteria

The following criteria were used to evaluate each type of tariff:

• **Fairness** – a tariff is considered fair if the waste holder pays in proportion to the waste it generates.

• **Familiarity** – if a current system functions well and is understood by payers, there is a strong argument to leave it in place. A well-functioning tariff system is one that: has a high revenue-collection rate (above 90%) and covers as much of the costs of providing the service as possible.

• **Transparency** – a tariff system in which the waste holder understands what it is paying for is preferred. When tariffs are not directly linked to waste generation, transparency is lower. Tariffs that are easy to calculate and therefore understandable by the customer are more transparent. On the other hand, when a customer cannot control charges made to it, the tariff system is not transparent.

• **Linkage between costs and services** – a tariff that creates a strong link between the costs of collection and disposal of waste and the service provided is preferred, as it signals waste holders that the generation of waste has consequences in terms of cost.

• **Predictability of revenue** – tariff systems that enable the generated revenue to be accurately estimated and planned are preferred.

• **Incentive for reducing production of waste** – tariff systems, that encourage waste reduction are preferred. On the other hand, the reduction of waste should not involve the illegal disposal or treatment of waste.

• **Incentive to reduce illegal dumping** – tariff systems should encourage the proper disposal and treatment of solid waste.

• **Incentive for recycling** – tariff systems that provide free collection of recyclables and that use revenues from recycling programmes to offset the costs of waste collection and disposal are preferred.

• **Ease of administration and enforcement** – tariff systems that are simple to administer should be preferred. Systems that are simple to administer also tend to have a higher collection efficiency (revenues actually collected as a percentage of revenues billed). At the same time, collection efficiency also depends on ease in enforcement as a key part of administration of a tariff system.

5.2 Types of tariffs

The following types of tariffs were evaluated according to the previously mentioned evaluation criteria:
Flat rate tariffs

These are tariffs that are calculated based on a given unit of calculation, such as unit of waste generated, number of inhabitants, etc. The following unit types are considered:

- Per person
- Floor space (square meters)
- Per household / customer
- Per unit of consumption of other utility service (such as water or electricity)
- Share of total contribution to waste stream
- Waste tax.

Variable rate tariffs

As the name suggests, variable tariffs differ according to the amount of waste generated. Two forms of variable rate tariffs are considered:

- **Weight-based tariff** – in a weight-based tariff, the waste holder pays for the actual amount of waste generated. Such a tariff requires that waste trucks be equipped with scales in order to measure the mass of the waste being disposed. Thus, the waste holder pays per unit of mass of waste (for example, kilogram or tonne). This tariff is not deemed suitable for Montenegro, in particular because it is practical to be implemented and generally not used in any country.

- **Volume-based tariff** – in a volume-based tariff, the waste holder pays for the volume of waste generated. Typically, however, the waste holder pays for a given available volume (for example, a container of a specified volume) whether or not the volume is actually used. In addition, the frequency at which waste is collected is a key variable in setting the tariff. For example, a container of a known volume may be collected twice per month, once per week, or more frequently depending on needs.

Uniform tariffs

Under uniform tariffs, various waste holders pay the same amount within their customer group, regardless of location and waste generation. For example, customers in a municipality located far from the regional landfill pay the same tariff for waste disposal as the customers in a municipality located next to the landfill. When applied across a diverse service area, uniform tariffs can also be used to subsidize localities with high unit costs.

Differentiated tariffs

Under differentiated tariffs, waste holders pay in proportion to their contribution to the waste stream and the costs of providing the service. Thus, waste holders of waste that is more costly to collect and treat should pay more than other waste holders. It also follows that all waste holders should pay the costs associated with the collection and treatment of their waste. This means that areas with high unit costs can be expected to pay more than areas with lower unit costs of service provision.

Essentially, all of the foregoing tariff types can be used for all customer types, such as private households as well as commercial and public institutions. In addition, the same considerations apply for both solid waste management tariff components: solid waste collection and disposal (gate, or tipping fee).
5.3 Qualitative review of tariff options

In this section, the types of tariffs proposed are evaluated according to the criteria proposed under section 5.1.

5.3.1 Flat-rate tariffs

Flat-rate tariffs tend to be more transparent as they are generally easy to understand and calculate, as long as adequate cost details and calculation guidelines are provided. Flat rates can be fair if they are based on a unit that is more clearly linked to solid waste generation. Flat rate tariffs are more familiar to waste holders in Montenegro, as they are currently in use (based on square metre of living space). Given that the unit based upon which the customer is charged is not always directly linked to solid waste, flat-rate tariffs tend to have weak linkages between the costs of providing the service and the level of service provided. Revenue is relatively easy to forecast under flat-rate tariffs. Flat-rate tariffs tend to provide little or no incentive to reduce waste or to recycle. There is some incentive to reduce illegal dumping, as the waste holders have to pay regardless of the amount of waste generated. Depending on the unit used to bill customers, flat-rate tariffs can be relatively easy to administer and enforce.

Various units about which billing may be based are examined under flat-rate tariffs, as follows:

Per person

Customers pay according to the number of inhabitants registered in a given household. This type of tariff is not suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is fair as generally speaking more inhabitants equal a higher contribution to the total waste stream. This type of tariff is familiar in many countries, but not presently practiced in Montenegro. The linkage between costs of providing services and the service itself is weak. The revenue stream from this basis is relatively predictable, provided data are updated on registered persons and business premises. In areas with out-migration (population is falling in rural areas, in particular in the Northern Region, and migrating to larger population centres throughout the country), revenue predictability is lower as the number of inhabitants decreases. In tourist areas, this tariff basis would lead to lower revenue predictability as temporary populations would not be registered. As with essentially all flat-rate tariffs, this tariff basis has no incentive to reduce waste, little incentive to increase recycling, and a small incentive to reduce illegal dumping (since payments are not based on actual calculated waste generation). This tariff basis is not easy to administer in areas with declining population and temporarily occupied dwellings, as it requires robust customer databases that are regularly updated. Enforcement of payment can be relatively easy if the customer has a contract with the waste collector.

Per square meter

Customers pay according to floor area of the given premises. This type of tariff is also suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is fair as generally speaking higher floor space equals a higher contribution to the total waste stream, though, for example, this correlation is not as strong as for the number of in-
habitants. The linkage between costs of providing services and the service itself is weak. This type of tariff is familiar in many countries and is presently practiced in Montenegro. The revenue stream from this basis is relatively predictable, provided data are updated on households and business premises. In tourist areas, this tariff basis would lead to lower revenue predictability as temporary dwellings may not be registered. As with essentially all flat-rate tariffs, this tariff basis has no incentive to reduce waste, little incentive to increase recycling, and a small incentive to reduce illegal dumping (since payments are not based on actual calculated waste generation). This tariff basis is relatively easy to administer, but requires a robust, and regularly updated customer database. Enforcement of payment can be relatively easy if the customer has a contract with the waste collector.

Per customer

Customers pay by virtue of signing up for waste services (for example, based on a contract). This type of tariff is also suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is not very fair as there is no direct linkage to the contribution to the total waste stream. This type of tariff is familiar in many countries, but not presently practiced in Montenegro for households (but is practiced for non-household customers). As the unit of measure is the customer, the linkage between the costs of the service and the service level provided is more readily apparent. The revenue stream from this basis is relatively predictable, provided data are updated on registered persons and business premises. In areas with out-migration (population is falling in rural areas, in particular in the Northern Region, and migrating to larger population centres throughout the country), revenue predictability is lower as customers may close accounts. In tourist areas, this tariff basis would lead to lower revenue predictability as temporary customers may not be registered. As with essentially all flat-rate tariffs, this tariff basis has no incentive to reduce waste, little incentive to increase recycling, and a small incentive to reduce illegal dumping (since payments are not based on actual calculated waste generation). This tariff basis is generally easier to administer than other flat-based systems, as it requires fewer data points. Still, a robust and regularly updated customer database is required. Enforcement of payment can be relatively easy if the customer has a contract with the waste collector.

Other unit of consumption (for example, m³ of water or as a percentage of electricity bill)

Customers pay according to a rate per unit of consumption of a more familiar product, such as per cubic meter of water consumed. This type of tariff is suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is generally not fair, since while there is a correlation between household income, water consumption, and solid waste generation, the linkage between the latter two is not direct. This type of tariff is used in countries such as Turkey (based on water consumption) and Armenia (as a percentage of electricity consumption), but is not presently practiced in Montenegro. The linkage between costs of providing services and the service itself is weak. The revenue stream from this basis can be unpredictable, unless robust data are available on water consumption per customer. In tourist areas, this tariff basis would lead to lower revenue predictability, as absent populations do not consume water. In Turkey, however, the rate per cubic metre of water is very low and bears no relationship to the costs of service provision. As a result, cost coverage is typically very low. Revenue collection rates are also...
typically not high. On the other hand, in Armenia, where waste customers pay according to 2% of their electricity bill, revenue collection rates are very high, presumably because it is easy to shut off electricity supply to a single customer.

As with essentially all flat-rate tariffs, this tariff basis has no incentive to reduce waste, little incentive to increase recycling, and a small incentive to reduce illegal dumping (since payments are not based on actual calculated waste generation). This tariff basis can be easy to administer with robust customer databases that are regularly updated. Enforcement of payment can be easy if the customer has a contract for both water and waste services, if payment habits for water services are high, if the solid waste tariff is collected together with the water tariff, and if there are viable mechanisms for the water service provider to compel payment. For example, water services could be suspended much more easily than solid waste services. The need to reinstate water services leads customers to pay bills.

Customers pay according to the amount and type of waste they generate. This type of tariff is suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is fair as it links the contribution to the waste stream to payments. This type of tariff is familiar in many countries in the form of gate fees at a landfill where the gate fee is distributed proportionally across the service area. Thus, a rural area contributing, for example, one percent of the total waste stream arriving at the landfill, would be expected to cover one percent of the landfill operating and maintenance costs. These costs would then be evenly divided among customers within that part of the service area. The linkage between costs of providing services and the service itself is strong. The revenue stream from this basis is relatively predictable, provided data are updated on waste flows from particular parts of the service area. As with essentially all flat-rate tariffs, this tariff basis has no incentive to reduce waste, little incentive to increase recycling, and a small incentive to reduce illegal dumping. This tariff basis is difficult to administer, as it requires robust means to measure waste flows from particular parts of the service area. It is also not easy to administer in areas with declining population and temporarily occupied dwellings, as it requires a robust and regularly updated customer database. Enforcement of payment can be relatively easy if the customer has a contract with the waste collector and thereby for proper disposal.

Customers pay a flat tax for being located in a given service area. Typically, this is based on the value of the property. This type of tariff is suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is not considered very fair as there is no direct linkage to the contribution to the total waste stream. In countries where it is practiced, such as the United Kingdom (as part of the council tax), it is considered by many as a regressive tax. This type of tariff is not presently practiced in Montenegro. The linkage between costs of providing services and the service itself is weak. The revenue stream from this basis is predictable, provided data are updated on property and business premises. In areas with out-migration (population is falling in rural areas, in particular in the Northern Region, and migrating to larger population centres throughout the country), revenue predictability is lower as the number of unoccupied premises increases. In tourist areas, this tar-
iff basis would lead to higher revenue predictability as temporary populations would still have to pay the tax regardless of usage of the system. As with essentially all flat-rate tariffs, this tariff basis has no incentive to reduce waste and little incentive to increase recycling. It does, however, provide an incentive to reduce illegal dumping, as the waste tax cannot be avoided. This tariff basis is not easy to administer, as it requires robust property databases that are regularly updated. Enforcement of payment, however, can be relatively easy as customers tend to pay taxes more than fees and collection mechanisms are stronger.

5.3.2 Variable-rate tariffs

Variable-rate tariffs tend to be very transparent as they are generally easy to understand and calculate, as long as adequate cost details and calculation guidelines are provided. Variable rates can be fair if they are based on actual solid waste generation. Variable-rate tariffs are not familiar to waste holders in Montenegro. The unit of measure based upon which the customer is charged can be directly linked to solid waste generation, which draws a direct link between the costs of providing the service and the level of service provided. Revenue is relatively easy to forecast under variable-rate tariffs. Variable-rate tariffs tend to provide some incentive to reduce waste and recycle. Typically, however, such tariffs provide a perverse incentive for illegal dumping, as the waste holders pay a fee closer to the actual amount of waste generated. Depending on the unit used to bill customers, variable-rate tariffs can be relatively easy to administer and enforce.

Variable-rate tariffs can be weight-based or volume-based; these are examined below:

Weight-based tariffs

Customers pay according to the actual mass of the waste generated. This type of tariff is suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is very fair, as customers pay for the waste stream they generate. This type of tariff is not practiced in Montenegro. The linkage between costs of providing services and the service itself is very strong. The revenue stream from this basis has low predictability, as the actual amount of waste delivered will vary at different times of the year; thus, proper cash flow management is crucial. In areas with out-migration, revenue predictability is lower as the number of inhabitants decreases. In tourist areas, this tariff basis would lead to lower revenue predictability as temporary populations would not produce any waste. As a variable-rate tariff, the weight-based tariff has a strong incentive to reduce waste and to recycle. Since customers pay directly for the mass of waste produced, there is also a strong small incentive for illegal dumping. This tariff basis is not easy to administer, as it requires a robust billing system and customer databases that are regularly updated. In fact, there are very few, if any, examples of its use around the world, in particular for households. Waste collection trucks require scales that measure the waste and these data must be fed into the customer database. Enforcement of payment can be made easier if the customer has a contract with the waste collector.
Volume-based tariffs, fixed volume

Customers pay according to a fixed volume of waste generated. This type of tariff is suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is relatively fair as customers pay for a given waste stream regardless of whether they use it. This type of tariff is used in many countries, but is not currently practiced in Montenegro. The linkage between costs of providing services and the service itself is relatively weak. The revenue stream from this basis has a very high predictability, as customers pay based on a fixed volume and waste collection frequency over a specified collection period (for example, a 100 litre container emptied four times per month). As a variable-rate tariff, the volume-based tariff has a small incentive to reduce waste and to recycle. Since customers pay regardless of actual waste produced, there is also a small disincentive for illegal dumping. This tariff basis is easy to administer, but still requires a robust billing system and customer databases that are regularly updated. Enforcement of payment can be made easier if the customer has a contract with the waste collector.

Volume-based tariffs, variable volume

Customers pay according to the actual volume of waste generated. This type of tariff is suitable for non-household customers or for temporarily occupied dwellings (such as vacation homes). This tariff basis is considered fair as customers pay for the waste stream they produce. This type of tariff is not widely used due to the complexity of its implementation and administration. The linkage between costs of providing services and the service itself is strong. The revenue stream from this basis has a very low predictability, as customers only pay for what they generate. As a variable-rate tariff, the volume-based tariff has a small incentive to reduce waste and to recycle. Since customers only pay for the waste they produce, there is a small incentive for illegal dumping. This tariff basis is very difficult to administer and a robust billing system and customer databases that are regularly updated are essential. Enforcement of payment can be made easier if the customer has a contract with the waste collector, but is considered problematic.

5.3.3 Uniform tariffs

Uniform tariffs refer to tariff systems that involve the same tariff across an entire service area or between customer groups. Uniform tariffs can be used support poorer areas and areas with high unit costs of collection (for example, in sparsely populated areas and those located far from the regional landfill). The fairness of such tariffs can be disputed, as on the one hand areas with lower unit costs would have to pay more overall in order for services to be affordable in areas with high unit costs. Thus, such tariffs are not always transparent, although generally they are easy to calculate, as long as adequate cost details and calculation guidelines are provided. Uniform tariffs are well-known in many countries. The unit of measure based upon which the customer is charged can be directly linked to solid waste generation. Revenue is relatively easy to forecast under uniform tariffs. Uniform tariffs tend to provide weak incentives to reduce waste and recycle and weak incentives to refrain from illegal dumping. Uniform tariffs are considered easy to administer and enforce.
5.3.4 Differentiated tariffs

Differentiated tariffs refer to tariff systems that involve the different tariffs in different parts of a service area or between different customer groups. Differentiated tariffs are considered fair and there are direct linkages between the cost of services and the services themselves. Such tariffs are considered transparent and are easy to calculate, as long as adequate cost details and calculation guidelines are provided. Differentiated tariffs are well-known in many countries, including Montenegro. The unit of measure based upon which the customer is charged can be directly linked to solid waste generation. Revenue is somewhat easy to forecast under differentiated tariffs. Differentiated tariffs tend to provide weak incentives to reduce waste and recycle, as well as perverse incentives to engage in illegal dumping. Differentiated tariffs can be difficult to administer and enforce, in particular if managed by a single entity for the entire service area.

Each tariff type discussed above is assessed on a scale from -3 to +3 for each evaluation criterion. A summary of this evaluation is presented in the following Table 15, Table 16 and Table 17.
Table 15  Qualitative evaluation of various flat-rate tariffs

<table>
<thead>
<tr>
<th>Type of tariff</th>
<th>Unit</th>
<th>Fairness</th>
<th>Familiarity</th>
<th>Transparency</th>
<th>Linkage: cost and services</th>
<th>Revenue predictability</th>
<th>Waste reduction incentive</th>
<th>Incentive to reduce illegal dumping</th>
<th>Incentive for recycling</th>
<th>Ease of administration</th>
<th>Ease of enforcement</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat rate tariffs</td>
<td>No. of inhabitants</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>---</td>
<td>+</td>
<td>-</td>
<td>--</td>
<td>+</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>Square meter</td>
<td>+</td>
<td>+++</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>---</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>6</td>
</tr>
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<td></td>
<td>Per customer (household, business)</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>---</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Unit of other consumption (e.g., m³ of water)</td>
<td>--</td>
<td>-</td>
<td>-</td>
<td>--</td>
<td>-</td>
<td>---</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+++</td>
<td>-6</td>
</tr>
<tr>
<td></td>
<td>Contribution to waste stream</td>
<td>+++</td>
<td>-</td>
<td>-</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>---</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Waste tax</td>
<td>-</td>
<td>--</td>
<td>+</td>
<td>-</td>
<td>+++</td>
<td>--</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>0</td>
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</tbody>
</table>

Source: Consultants assessment
### Table 16 Qualitative evaluation of various variable-rate tariffs

<table>
<thead>
<tr>
<th>Type of tariff</th>
<th>Unit</th>
<th>Fairness</th>
<th>Familiarity</th>
<th>Transparency</th>
<th>Linkage: cost and services</th>
<th>Revenue predictability</th>
<th>Waste reduction incentive</th>
<th>Incentive to reduce illegal dumping</th>
<th>Incentive for recycling</th>
<th>Ease of administration</th>
<th>Ease of enforcement</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight-based (kg, tonne, etc.)</td>
<td></td>
<td>+++</td>
<td>---</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>---</td>
<td>++</td>
<td>---</td>
<td>--</td>
<td>-1</td>
</tr>
<tr>
<td>Variable rate tariff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume-based (fixed volume, pay regardless of use)</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>++</td>
<td>-13</td>
<td></td>
</tr>
<tr>
<td>Volume-based (fixed volume, pay only when used)</td>
<td>++</td>
<td>--</td>
<td>++</td>
<td>++</td>
<td>---</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>---</td>
<td>---</td>
<td>-6</td>
<td></td>
</tr>
</tbody>
</table>

Source: Consultants assessment

### Table 17 Qualitative evaluation of uniform and differentiated tariffs

<table>
<thead>
<tr>
<th>Type of tariff</th>
<th>Unit</th>
<th>Fairness</th>
<th>Familiarity</th>
<th>Transparency</th>
<th>Linkage: cost and services</th>
<th>Revenue predictability</th>
<th>Waste reduction incentive</th>
<th>Incentive to reduce illegal dumping</th>
<th>Incentive for recycling</th>
<th>Ease of administration</th>
<th>Ease of enforcement</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform tariff across service area and customer groups</td>
<td>Any (as in previous tables)</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+++</td>
<td>++</td>
<td>9</td>
</tr>
<tr>
<td>Differentiated tariff across service area and customer groups</td>
<td>Any (as in previous tables)</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>---</td>
<td>-</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Consultants assessment
The tariff systems with the highest raw scores are the following:

- Among flat-rate tariffs:
  - per customer (household, commercial entity): 9
  - per square meter: 6.

- Among variable-rate tariffs:
  - per pre-defined volume: 13
  - Per weight: -1.

- Uniform tariff: 9

- Differentiated tariff: 0.

Accordingly, considering the current level of development of solid waste management services in Montenegro, a tariff system based on pre-defined volumes that are uniform across the service area should be preferred. Uniform tariffs based on per customer or per square meter (as is currently the case) are also acceptable tariff systems.

These conclusions were then tested according to various weighting scenarios, in which the various evaluation criteria were weighted against one another, as follows:

- Scenario 1: equal weights
- Scenario 2: higher weight to ease of administration and enforcement
- Scenario 3: higher weight to revenue generation
- Scenario 4: higher weight to fairness and transparency
- Scenario 5: higher weight to waste reduction, recycling, and addressing illegal dumping.

Accordingly, the weights are provided as in Table 18.
Table 18  Evaluation criteria weights, by scenario

<table>
<thead>
<tr>
<th></th>
<th>Scenario 1: Equal weight</th>
<th>Scenario 2: Ease of administration and enforcement</th>
<th>Scenario 3: Revenue generation</th>
<th>Scenario 4: Fairness and transparency</th>
<th>Scenario 5: Waste reduction, recycling, illegal dumping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairness</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>23</td>
<td>5</td>
</tr>
<tr>
<td>Familiarity</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Transparency</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>22</td>
<td>5</td>
</tr>
<tr>
<td>Linkage: cost and services</td>
<td>10</td>
<td>5</td>
<td>30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Revenue predictability</td>
<td>10</td>
<td>5</td>
<td>30</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Waste reduction incentive</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Recycling incentive</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Reduce illegal dumping incentive</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>Ease of administration</td>
<td>10</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Ease of enforcement</td>
<td>10</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Consultants assessment

Scenario 1  
The results of Scenario 1 are already provided above.

Scenario 2  
The tariff systems with the highest weighted scores under Scenario 2 (administration and enforcement) are the following:

- Among flat-rate tariffs:
  - per customer (household, commercial entity): 145
  - per square meter: 80
  - other unit of consumption: 70.

- Among variable-rate tariffs:
  - Per pre-defined volume: 190
  - Per weight: -130.

- Uniform tariff: 170

- Differentiated tariff: -100.

The conclusion for Scenario 2 is the same as for Scenario 1. Accordingly, considering the current level of development of solid waste management services in Montenegro, a tariff system based on pre-defined volumes that are uniform across the service area should be preferred. Uniform tariffs based on per customer or per square meter (as is currently the case) are also acceptable tariff systems.
Scenario 3

The tariff systems with the highest weighted scores under Scenario 3 (revenue generation) are the following:

- Among flat-rate tariffs:
  - per customer (household, commercial entity): 145
  - contribution to waste stream: 115
  - per square meter: 55.

- Among variable-rate tariffs:
  - Per pre-defined volume: 165
  - Per weight: -5.

- Uniform tariff: 120

- Differentiated tariff: 75.

The conclusion for Scenario 3 is the same as for Scenario 1.

Scenario 4

The tariff systems with the highest weighted scores under Scenario 4 (fairness and transparency) are the following:

- Among flat-rate tariffs:
  - per square meter: 127
  - per customer (household, commercial entity): 112.

- Among variable-rate tariffs:
  - Per pre-defined volume: 85
  - Per weight: 55
  - Per volume, actual use only: 10.

- Uniform tariff: 74

- Differentiated tariff: 55.

The conclusion for Scenario 4 is nearly the same as for Scenario 1, except that the current square meter basis is preferred.

Scenario 5

The tariff systems with the highest weighted scores under Scenario 5 (waste reduction, recycling, reducing illegal dumping) are the following:

- Among flat-rate tariffs:
  - Contribution to waste stream: 52
  - per customer (household, commercial entity): -11
  - waste tax: -23.

- Among variable-rate tariffs:
- Per pre-defined volume: 155
- Per weight: 20.

- Uniform tariff: 29
- Differentiated tariff: -29.

The conclusion for Scenario 5 differs from that for Scenario 1. In Scenario 5, while uniform tariffs are deemed the most effective, a volume-based tariff is clearly preferred together with a landfill tipping fee set in proportion to the actual contribution to the waste stream.

5.4 Conclusion

In conclusion, the following tariff-types should be examined further on a quantitative basis:

- Fixed-rate tariffs based on: number of customers and number of square meters
- Variable-rate tariffs based on pre-defined volumes
- Uniform and differentiated tariffs.

These are considered in the next chapter.
6 Review of Various Tariff Models

This section reviews the proposed tariff structures in each of the service areas studied in this report. While care has been taken to collect accurate data from each of the service areas, it was not always possible to obtain the most up-to-date data from each of the local service providers. Actual field data on landfill construction and operating costs, as well as operating costs of collection systems, may vary from the assumptions presented earlier. The outcome of this section, however, is the type of tariff that would be best to use in each of the service areas, taking into account both the qualitative review presented in the previous chapter, as well as the quantitative review contained in the present chapter.

In this section, the various tariff types are examined based on the best available data from the three service areas presented in Chapter 4.

This chapter contains the following sections:

- Input data – list of input data used in the tariff model
- Full-cost recovery tariff – calculation of the full-cost recovery
- Tariff models – presentation of various tariff models, based on the full-cost recovery tariffs and compared with assumptions on affordability
- Proposed future tariff system and structure, by service area.

6.1 Input data

The tariff calculation models encompass a 31-year period (2012-2043). These 31 years include 20 years of landfill operation and 10 years of aftercare period (for the first phase of the landfill investment).

Assumptions

A number of general assumptions that are used throughout the chapter are summarised below:

- 2012 is used as basis for evaluation and all values are discounted back to 2012
- Financial calculations are made in real terms, i.e. constant 2012 prices in EUR
- VAT and other taxes are excluded from calculations
Infrastructure Projects Facility – Technical Assistance Window
Sub project: WB4-MNE-ENV-12B: Review of tariff models and propose tariff models for the future operation Management Models and Options for Cost Recovery for the Future Construction and Operation of Regional Landfills in Montenegro

- Land costs are excluded from the calculations
- A real discount rate of 5% per annum is used
- The maximum affordable tariff is assumed as 1% of average disposable household income.

Input data

The following input data (raw and calculated) were used in the tariff calculation model for each of the studied service areas:

- Demographic and generic data - forecasts for urban and rural population by municipalities and number of households
- Waste flow forecasts per activity, customer type (urban HH, rural HH and others) and by municipality
- Existing assets (vehicle, containers and other equipment) of the PUCs, mainly for waste collection activities: numbers, approximate age, estimated purchase costs, remaining value
- Operating costs for waste collection activities – broken down by personnel, fuel and energy, maintenance, etc.
- Investment costs of new investments – mostly for landfills (including recycling centre for Nikšić and composting plant for Pljevlja in future)
- Replacement costs of the existing assets (for waste collection) that have already exceeded their useful lifetimes.
- Current tariffs for waste services by customer type (HHs and others), revenue collection ratios
- Loan disbursements for the new investments (if any)

These input data were based on the best available data from the public utility companies (PUC) of each of the municipalities in the three service areas presented in Chapter 4. Additional information was obtained from the individual feasibility studies for solid waste management in regional landfills in the Nikšić, Plužine, and Šavnik service area and the Pljevlja and Žabljak service area. For the Ulcinj and Bar service area, data were collected directly from the municipalities and PUCs.

Data on local solid waste generation are limited and based on local estimates rather than actual measured waste (the landfill in the Ulcinj and Bar Service Area was opened in the summer of 2012, whereas the other two service areas do not have landfills equipped with scales). There are also uncertainties in the current costs of solid waste management services given that solid waste services are provided by multi-purpose PUCs and the accounting is not sufficiently detailed to be certain that the actual costs of collection have been identified. In one of the municipalities (Pljevlja), there is evidence that solid waste tariffs exceed the full-cost recovery tariffs, meaning that solid waste tariffs subsidise other municipal activities.
With these limitations in mind, the next section calculates the full-cost recovery tariffs for solid waste services in each of the three service areas.

### 6.2 Cost covering tariff

For each of the service areas, the cost covering tariff is calculated using a cost per ton basis. These are shown in Table 19.

**Table 19  Cost covering tariffs for SWM per municipality, excluding VAT**

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Unit</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikšić</td>
<td>EUR/tonnes</td>
<td>112.6</td>
<td>113.9</td>
<td>160.0</td>
<td>171.7</td>
<td>141.7</td>
<td>130.6</td>
<td>135.1</td>
<td>117.5</td>
<td>108.1</td>
</tr>
<tr>
<td>Plužine</td>
<td>EUR/tonnes</td>
<td>322.0</td>
<td>321.1</td>
<td>375.5</td>
<td>394.3</td>
<td>364.4</td>
<td>313.8</td>
<td>318.8</td>
<td>307.5</td>
<td>304.4</td>
</tr>
<tr>
<td>Šavnik</td>
<td>EUR/tonnes</td>
<td>183.8</td>
<td>189.7</td>
<td>228.4</td>
<td>237.9</td>
<td>225.5</td>
<td>216.7</td>
<td>229.3</td>
<td>220.0</td>
<td>219.1</td>
</tr>
<tr>
<td>Union (NPS)</td>
<td>EUR/tonnes</td>
<td>123.0</td>
<td>124.3</td>
<td>170.4</td>
<td>182.1</td>
<td>151.9</td>
<td>138.8</td>
<td>142.9</td>
<td>125.1</td>
<td>115.6</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>EUR/tonnes</td>
<td>155.6</td>
<td>155.0</td>
<td>149.6</td>
<td>163.1</td>
<td>240.5</td>
<td>194.6</td>
<td>189.7</td>
<td>183.3</td>
<td>197.1</td>
</tr>
<tr>
<td>Žabljak</td>
<td>EUR/tonnes</td>
<td>124.4</td>
<td>122.7</td>
<td>120.2</td>
<td>135.0</td>
<td>202.9</td>
<td>171.9</td>
<td>168.4</td>
<td>163.2</td>
<td>175.5</td>
</tr>
<tr>
<td>Union (PZ)</td>
<td>EUR/tonnes</td>
<td>151.9</td>
<td>151.2</td>
<td>146.2</td>
<td>159.8</td>
<td>236.1</td>
<td>191.9</td>
<td>187.2</td>
<td>180.9</td>
<td>194.6</td>
</tr>
<tr>
<td>Bar</td>
<td>EUR/tonnes</td>
<td>53.7</td>
<td>65.6</td>
<td>78.6</td>
<td>78.8</td>
<td>87.6</td>
<td>61.2</td>
<td>58.7</td>
<td>53.8</td>
<td>44.1</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>EUR/tonnes</td>
<td>75.8</td>
<td>87.7</td>
<td>100.7</td>
<td>100.0</td>
<td>103.6</td>
<td>71.6</td>
<td>63.7</td>
<td>58.1</td>
<td>48.7</td>
</tr>
<tr>
<td>Union (BU)</td>
<td>EUR/tonnes</td>
<td>61.2</td>
<td>73.1</td>
<td>86.1</td>
<td>86.0</td>
<td>93.0</td>
<td>64.7</td>
<td>60.4</td>
<td>55.3</td>
<td>45.6</td>
</tr>
</tbody>
</table>

Source: Model calculations

The components of a cost covering tariff are presented in Annex 1.

### 6.3 Tariff models

In this section, the following tariff models are examined for each of the service areas:

**Fixed tariff**

A fixed tariff based on an agreed unit. In this section, the following are examined: per household, per person, per square meter and per tonne.

**Variable tariff**

A volume-based variable tariff was examined for each of the municipalities in the service areas under study (per container). The frequency of waste collection was not considered and thus the tariff is per container, per year. It is a matter of local policy to break this down into collection periods. A weight-based tariff was not considered, as it was disqualified for further consideration in the previous chapter.

**Uniform tariff**

Both collection and gate fee – across the entire service area.

---

7 The large difference in the cost per tonne for Plužine and Bar comes from the difference between the collected waste amounts in this municipal union. While the permanent population of the Bar Union is around 78% of the Nikšić Union population, the collected waste amount of Nikšić is approximately 64% of the collected waste amount of Bar Union. The reasons for these differences can be the tourism effects on the waste generation and economies of scale.
Differentiated tariff  Collection and gate fees are differentiated by type of customer (residential and non-residential) as well as by location in the service area (urban versus rural, proximity to landfill, etc.).

The following tariff model options are considered in this chapter:

Option I  Uniform SWM tariffs applied in the Municipal Unions (i.e., one tariff throughout the municipal union and for the entire system costs, i.e., collections and disposal)

Option II  Uniform SWM tariffs applied per Municipality (i.e., different tariffs in each municipality according to calculated costs, but tariff includes the entire system costs, i.e., collections and disposal)

Option III  Uniform waste disposal tariffs applied (i.e., different waste collection costs in each municipality, but uniform disposal costs in all municipalities in the service area)

Option IV  Variable tariffs for collection and disposal per municipality (i.e., different waste collection and disposal tariffs in each municipality).

The following table (Table 20) presents the average full-cost recovery tariffs over the period of analysis according to each particular tariff basis.
## Table 20  
Average tariffs for overall period (20 years) based on different CCT options, urban HH and rural HH customers

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Unit</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Option I</td>
<td>Option II</td>
<td>Option III</td>
</tr>
<tr>
<td>Niksic</td>
<td>EUR/HH</td>
<td>101.0</td>
<td>93.4</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>30.3</td>
<td>28.0</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>108.4</td>
<td>100.3</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>39.8</td>
<td>36.8</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Pluzine</td>
<td>EUR/HH</td>
<td>101.0</td>
<td>239.1</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>35.5</td>
<td>83.9</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>127.1</td>
<td>300.2</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>46.6</td>
<td>110.1</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Savnik</td>
<td>EUR/HH</td>
<td>101.0</td>
<td>160.3</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>33.9</td>
<td>53.8</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>121.5</td>
<td>192.2</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>44.6</td>
<td>70.5</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>EUR/HH</td>
<td>97.3</td>
<td>95.6</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>34.1</td>
<td>33.5</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>203.1</td>
<td>199.5</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>74.5</td>
<td>73.2</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Zabljak</td>
<td>EUR/HH</td>
<td>97.3</td>
<td>122.1</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>34.8</td>
<td>43.6</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>141.7</td>
<td>173.4</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>52.0</td>
<td>63.6</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Bar</td>
<td>EUR/HH</td>
<td>124.5</td>
<td>82.6</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>42.1</td>
<td>27.9</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>94.1</td>
<td>62.1</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>34.5</td>
<td>22.8</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Ulicinj</td>
<td>EUR/HH</td>
<td>124.5</td>
<td>120.4</td>
</tr>
<tr>
<td></td>
<td>EUR/ca</td>
<td>36.3</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>EUR/tonnes</td>
<td>75.1</td>
<td>72.5</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>27.5</td>
<td>26.6</td>
</tr>
<tr>
<td></td>
<td>EUR/m2</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Source: Model calculations
Table 21  Key for the lowest tariff options for urban HH and rural HH customers

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Option I</td>
<td>Option II</td>
</tr>
<tr>
<td>Nikšić</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pluzine</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Savnik</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Zabljak</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Bar</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: Table 20.

In general, it is seen that Option I (uniform tariffs throughout service area) is preferable (yields a lower tariff) for the urban and rural areas of sparsely populated municipalities, such as Plužine and Šavnik, while Option IV (variable tariffs for collection and disposal per municipality) is preferred in larger municipalities (Nikšić) and municipalities that are more uniform in population and income (Pljevlja and Žabljak, as well as Bar and Ulcinj). Option IV is generally preferred in urban areas.
Table 22  Average tariffs for overall period (20 years) based on different CCT options, non HHs

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Unit</th>
<th>Option I</th>
<th>Option II</th>
<th>Option III</th>
<th>Option IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niksic</td>
<td>EUR/tonnes</td>
<td>140.2</td>
<td>131.6</td>
<td>131.6</td>
<td>129.2</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>233.7</td>
<td>219.3</td>
<td>219.4</td>
<td>215.4</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>11.5</td>
<td>10.8</td>
<td>10.8</td>
<td>10.6</td>
</tr>
<tr>
<td>Pluzine</td>
<td>EUR/tonnes</td>
<td>140.2</td>
<td>331.5</td>
<td>329.1</td>
<td>286.8</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>233.7</td>
<td>552.5</td>
<td>548.5</td>
<td>478.0</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>23.3</td>
<td>54.9</td>
<td>54.5</td>
<td>47.5</td>
</tr>
<tr>
<td>Savnik</td>
<td>EUR/tonnes</td>
<td>140.2</td>
<td>223.5</td>
<td>224.5</td>
<td>181.6</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>233.7</td>
<td>372.5</td>
<td>374.1</td>
<td>302.7</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>3.5</td>
<td>5.5</td>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>EUR/tonnes</td>
<td>196.4</td>
<td>199.5</td>
<td>198.2</td>
<td>188.6</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>327.4</td>
<td>332.5</td>
<td>330.3</td>
<td>314.3</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>40.3</td>
<td>40.9</td>
<td>40.6</td>
<td>38.6</td>
</tr>
<tr>
<td>Zabljak</td>
<td>EUR/tonnes</td>
<td>196.4</td>
<td>173.4</td>
<td>183.6</td>
<td>111.3</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>327.4</td>
<td>288.9</td>
<td>306.0</td>
<td>185.5</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>10.1</td>
<td>8.9</td>
<td>9.5</td>
<td>5.7</td>
</tr>
<tr>
<td>Bar</td>
<td>EUR/tonnes</td>
<td>65.6</td>
<td>62.1</td>
<td>62.0</td>
<td>55.7</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>109.4</td>
<td>103.5</td>
<td>103.4</td>
<td>92.8</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>1.5</td>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>EUR/tonnes</td>
<td>65.6</td>
<td>72.5</td>
<td>72.7</td>
<td>60.4</td>
</tr>
<tr>
<td></td>
<td>EUR/container</td>
<td>109.4</td>
<td>120.8</td>
<td>121.1</td>
<td>100.6</td>
</tr>
<tr>
<td></td>
<td>EUR/m³</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Source: Model calculations

Table 23  Key for the lowest tariff options for Non HHs

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niksic</td>
<td>√</td>
</tr>
<tr>
<td>Pluzine</td>
<td>√</td>
</tr>
<tr>
<td>Savnik</td>
<td>√</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>√</td>
</tr>
<tr>
<td>Zabljak</td>
<td>√</td>
</tr>
<tr>
<td>Bar</td>
<td>√</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>√</td>
</tr>
</tbody>
</table>

Source: Table 23.

Thus, it is seen that for non-household tariffs, the conclusions are that the small municipalities of the Nikšić, Plužine, and Šavnik service area favouring Option I (uniform tariffs across the service area), whereas for the other municipalities studied Option IV (variable tariffs for collection and disposal per municipality) yields the lowest tariffs.
6.4 Full-cost recovery and affordability

If the calculated full cost recovery tariff would exceed the assumed limits for household affordability (in the sample service areas, 1% of average disposable household income was assumed), a decision is needed on how to address the issue. As a PUC should operate as a commercial entity, it should be able to use a tariff it needs to cover costs. If calculated full cost recovery tariffs exceed affordability limits, the following measures can be considered:

- **Do nothing** – the PUC charges, and the local regulator approves, the tariff required to cover the full costs of service provision. Customer behaviour is monitored (payments) and proper disposal of municipal solid waste is enforced.

- **Direct subsidy to households** – the municipality determines which household income groups would have difficulty paying for solid waste services (taking into account their other expenditures, in particular on other municipal services) and provides direct income support to them. Otherwise, the PUC charges the full-cost recovery tariff. This method is preferred, although it can be very data-intensive correctly to implement.

- **Cross-subsidy between customer groups or across the service area** – some customer groups can be charged higher tariffs in order for poorer households to have an affordable tariff. Customers in areas with high unit costs of services (such as sparsely populated municipalities located far from a landfill) can also be subsidised in this manner. If non-household customers generate typical municipal solid waste that is not distinguishable from household waste and they pay higher rates than households, this approach is not strictly in accordance with the polluter pays principle.

- **Direct transfer from the municipality to the public utility company or system operator** – provided that the tariff has been calculated according to the agreed-upon methodology, the entity responsible for solid waste services (municipality) pays the service provider the shortfall between the cost recovery level and the level that it is possible for customers to pay. The disadvantage to this approach is that it does not provide an incentive for the service provider to seek cost savings. As a PUC should be operated as a commercial entity, this option should be used as a last resort.

In this section, the consequences of the calculated full-cost recovery tariff exceeding the assumed affordability limits are discussed.

The following tables present a comparison of the full-cost recovery tariffs (based on Option I, as described above) with the assumed affordability limit of 1% of average disposable household income. The first table presents the situation for urban households and the second for rural households. Whenever the threshold of 1% is exceeded, the municipalities, individually and jointly, need to decide which of the four tariff policy options described above they will pursue.
A more detailed discussion on affordability is contained in Annex 2.

In the event that the municipalities follow the fourth (and least preferred) tariff policy, the following table presents the periods and subsidy levels that would be required in each of the service areas.

### Table 24 Affordability ratios for urban HHs

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Unit</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikšić</td>
<td>%</td>
<td>1.4%</td>
<td>1.4%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>1.4%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Plužine</td>
<td>%</td>
<td>1.4%</td>
<td>1.4%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>1.4%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Šavnik</td>
<td>%</td>
<td>1.4%</td>
<td>1.4%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>1.4%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td><strong>Union (NPS)</strong></td>
<td>%</td>
<td>1.4%</td>
<td>1.4%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>1.4%</td>
<td>1.1%</td>
<td>1.0%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>%</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.7%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>0.7%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Žabljak</td>
<td>%</td>
<td>0.5%</td>
<td>0.5%</td>
<td>0.5%</td>
<td>0.6%</td>
<td>1.2%</td>
<td>1.0%</td>
<td>1.0%</td>
<td>0.9%</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Union (PZ)</strong></td>
<td>%</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.7%</td>
<td>1.1%</td>
<td>0.9%</td>
<td>0.8%</td>
<td>0.7%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Bar</td>
<td>%</td>
<td>1.6%</td>
<td>1.9%</td>
<td>2.2%</td>
<td>2.1%</td>
<td>2.0%</td>
<td>1.4%</td>
<td>1.2%</td>
<td>1.1%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>%</td>
<td>1.6%</td>
<td>1.9%</td>
<td>2.2%</td>
<td>2.1%</td>
<td>2.0%</td>
<td>1.4%</td>
<td>1.2%</td>
<td>1.1%</td>
<td>0.8%</td>
</tr>
<tr>
<td><strong>Union (BU)</strong></td>
<td>%</td>
<td>1.6%</td>
<td>1.9%</td>
<td>2.2%</td>
<td>2.1%</td>
<td>2.0%</td>
<td>1.4%</td>
<td>1.2%</td>
<td>1.1%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Source: Model calculations

### Table 25 Affordability ratios for rural HHs

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Unit</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nikšić</td>
<td>%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>1.3%</td>
<td>1.1%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Plužine</td>
<td>%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>1.3%</td>
<td>1.1%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Šavnik</td>
<td>%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>1.3%</td>
<td>1.1%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>Union (NPS)</strong></td>
<td>%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>1.3%</td>
<td>1.1%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>1.1%</td>
<td>2.3%</td>
<td>1.7%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Žabljak</td>
<td>%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.3%</td>
<td>0.4%</td>
<td>0.8%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.6%</td>
<td>0.6%</td>
</tr>
<tr>
<td><strong>Union (PZ)</strong></td>
<td>%</td>
<td>0.6%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.9%</td>
<td>2.0%</td>
<td>1.5%</td>
<td>1.2%</td>
<td>1.1%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Bar</td>
<td>%</td>
<td>1.4%</td>
<td>1.7%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>1.4%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td>Ulcinj</td>
<td>%</td>
<td>1.4%</td>
<td>1.7%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>1.4%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>0.9%</td>
</tr>
<tr>
<td><strong>Union (BU)</strong></td>
<td>%</td>
<td>1.4%</td>
<td>1.7%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>2.0%</td>
<td>1.4%</td>
<td>1.3%</td>
<td>1.2%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

Source: Model calculations

In the event that the municipalities follow the fourth (and least preferred) tariff policy, the following table presents the periods and subsidy levels that would be required in each of the service areas.

### Table 26 Amount of required subsidies (Option 1)

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Period</th>
<th>Required Subsidy - Total</th>
<th>Required Subsidy - Yearly average</th>
<th>Loans</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Union (NPS)</strong></td>
<td>2012-2020, 2023-2025, 2033</td>
<td>7,435,994</td>
<td>232,375</td>
<td>3,000,000 II Phase of Landfill</td>
</tr>
<tr>
<td><strong>Union (PZ)</strong></td>
<td>2012-2021, 2034-2036</td>
<td>4,972,315</td>
<td>155,385</td>
<td>900,000 Reinvestments</td>
</tr>
<tr>
<td><strong>Union (BU)</strong></td>
<td>2013-2022</td>
<td>7,062,305</td>
<td>220,697</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Model calculations
6.5 Proposed future tariff structure

The following tariff policy recommendations are offered:

- Uniform SWM tariffs within particular customer groups should be preferred.

- Revenue collection rates need to be brought up to a range of 90-95% on a consistent basis.

- The tariff basis for household customers should be square meter (as is currently the case), number of registered persons, number of households. Per container fees can be considered when customer databases have been updated and revenue collection rates reach 90-95% on a consistent basis. In addition, prior to implementing such a tariff basis, public awareness about SWM should be raised and customers should have viable options to reduce waste (composting, recycling, etc.), if they prove feasible.

- The tariff basis for non-household customers should be based on a per container fee.

- Customer databases require upgrading and updating, which can be done in parallel to other efforts to improve property registries, etc. Until such time as these databases are upgraded, more innovative tariff bases are not recommended.

- As an example of an innovative tariff basis, the weight-based tariff is fair, encourages waste reduction (though illegal dumping needs to be policed), and complies with the polluter pays principle. Such tariffs for household customers should not be considered, however, as there are few if any examples of their application in practice in the world.

- In tourist areas, tariffs should be collected year-round and the tariff rates should not differ from the tourist and non-tourist season. This enables the PUC to have a more predictable cash flow, as well as provides customers with a lower monthly payment (but paid throughout the year). On the other hand, this puts less pressure on municipalities and PUCs to track occupancies of vacation properties.
7 Solid Waste Tariff Strategy

The following chapter constitutes a strategy for implementation of solid waste management tariffs. This strategy builds on the findings of the Activity 3 Report (Procurement Options Report), which is summarised in Chapter 3. It also builds on the findings from the review of three service areas in Montenegro (see Chapter 4), a review of the available options for tariff setting (Chapter 5), and the sample tariff calculations for the three service areas (Chapter 6).

The purpose of the Solid Waste Tariff Strategy is to provide a framework for the Government of Montenegro and municipalities for setting solid waste tariffs that are consistent with national policy documents (Solid Waste Master Plan, National Waste Policy) and national laws (Law on Waste Management). It is also intended to emphasise key principles in solid waste management that should govern the sector, specifically:

• Polluter pays
• Waste hierarchy
• Cost recovery
• Self-financing of solid waste services, together with financial and managerial autonomy of service providers
• Affordability, in particular for household customers.

7.1 Mission and vision for solid waste tariff strategy

The proposed mission for the Solid Waste Tariff Strategy is:

“To promote the sustainable development of Montenegro in the field of solid waste management.”

7.2 Values and vision

In implementing the mission, the following values are to be communicated as part of the Solid Waste Tariff Strategy:

• Promote sustainable development in solid waste management
• Promote the principles of the waste hierarchy, in which waste is handled according to the following priorities, in order: prevention, reuse, recycling, recovery, and disposal

• Apply the polluter pays principle in solid waste management, according to which the waste holder is responsible for its proper handling, in accordance with the waste hierarchy principle

• Promote cost recovery in solid waste management

• Promote financial autonomy of solid waste service providers

• Support managerial autonomy of solid waste service providers

• Encourage private sector participation in the delivery of solid waste management services.

Based on the mission statement and values, the proposed vision of the Solid Waste Tariff Strategy is that:

“The Government of Montenegro envisions solid waste tariffs that enable municipalities to be effective environmental stewards by following the waste hierarchy principle and pursuing full cost recovery in the provision of solid waste management services.”

7.3 Strategic objectives

The principles for setting solid waste management tariffs are set out in several key documents, such as the Law on Waste Management of the Republic of Montenegro.

Overall objectives

The overall objectives of the Solid Waste Tariff Strategy are to:

• Objective 1: Apply polluter pays and waste hierarchy principles in solid waste management

• Objective 2: Achieve financial sustainability in the provision of solid waste management services

• Objective 3: Implement local tariff policy that accounts for customer ability-to-pay for solid waste management services (affordability)

• Objective 4: Promote financial and managerial autonomy of solid waste service providers.

Each of these objectives is discussed in turn below. For each objective, policies and specific measures are listed that are intended to support the achievement of each objective, and thereby the mission and vision of this Solid Waste Tariff Strategy. In each case, indicators are recommended, according to which it will be possible to measure whether the objectives of the Solid Waste Tariff Strategy are being achieved.
7.4 Objectives and measures

Within each objective, a set of specific measures is described that should be implemented in order to achieve the given objective. Next, the priority of each measure is given, along with indicative dates for their implementation. Finally, a set of indicators is presented within each objective to be used to track progress toward meeting the objective.

7.4.1 Objective 1: Apply polluter pays and waste hierarchy principles in solid waste management

The Law on Waste Management of the Republic of Montenegro establishes that the “waste holder shall pay the costs of waste collection, transportation and treatment in accordance with the "polluter pays" principle” and that “the costs of waste management shall be borne by manufacturers, importers and distributors of product from which the waste originates.”

Accordingly, the generators of waste – the polluters – have to pay the costs of waste collection, transport and treatment. From this, it can also be inferred that the full costs of providing waste management services needed to be covered by the available means.

The waste hierarchy encourages the adoption of options for managing waste in the following order of priority:

- Waste should be prevented or reduced at source as far as possible.
- Where waste cannot be prevented, waste materials should be reused.
- Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material.
- Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources.
- Only if waste cannot be prevented, reclaimed or recovered, should it be disposed of into the environment by landfilling, and this should only be undertaken in a controlled manner.

Accordingly, policies need to be implemented and measures taken to promote the application of this hierarchy in practice. The hierarchy already appears in legislation in the Law on Waste Management and is also reflected in national waste targets.

In addition to construction of adequate waste handling facilities, including collection, composting, recycling, and landfilling, it is important to raise public awareness.

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awareness about solid waste management. In addition, enforcement mechanisms need to be developed and implemented.

This objective will be accomplished over the long-term, as waste management targets will be achieved once sufficient facilities for waste handling - composting, recycling, landfilling – are implemented.

Measures

**Measure 1.1. Public awareness campaign for solid waste management**

Public awareness needs to be raised on proper waste handling. In addition, local stakeholders should be involved in the development and implementation of collection systems, in particular dual collection systems. Community participation is essential in reducing overall quantities of waste and to this end the public should be encouraged to play their part in segregating waste and handing over recyclable materials to the informal/formal recycling sector. Willingness-to-pay for solid waste services should also be investigated (see Measure 3.1).

Typically, only a small proportion of the public is aware of what happens to their waste and the full extent of services being provided by the municipality. In fact, if waste is removed at the agreed frequency, the public will typically see little difference, apart from an increase in waste tariffs. This may lead to a loss in public support for solid waste management. To this end, awareness also needs to be raised about the potential health, safety and environmental impacts associated with poor waste management or the benefits of recycling.

Public awareness is important in order to ensure support for initiatives aimed at improving cleanliness in the municipality, in particular exerting pressure to cease illegal dumping. Awareness raising helps increase standards and public expectations as the public become increasing aware and active in improving their living environment. As standards and expectations increase, subsequent opportunities to improve solid waste management practices will arise.

The main objectives of public awareness campaigns in solid waste management are to:

- Inform the public of new methods and requirements in solid waste management (in particular, dual collection, disposal at landfill, etc.)
- Gain public support for solid waste management initiatives
- Build support for solid waste management – as customers understand the positive effects of SWM, they will increase their support for it and its related initiatives. This will build a positive image of solid waste management.

**Measure 1.2. Development of enforcement mechanisms**

Enforcement in solid waste management is required in three main areas:

- **Policing / controlling illegal dumping** – as regional landfills become operational, it is inevitable that solid waste tariffs will increase. Illegal dumping can also be expected to increase and municipalities and PUCs must re-
double efforts to control illegal dumping, in particular by assessing fines. A municipal hotline / webpage can be established where citizens can report and submit pictures of illegal dumpsites and thereby the municipality and PUC can be held accountable for addressing the issue, including pursuing guilty parties.

- **Payment for solid waste management services** – collection rates (measured by comparing the amount paid in a given period to the amounts billed for the same period). Ideally, this figure should approach 100% for a given period.

- **Develop enforcement mechanisms** – PUCs, supported by municipalities, need to pursue all late payments and cease the practice of allowing partial payments. For example, customers can be assigned a single, unified municipal services customer number, according to which all municipal databases are linked and it can be checked whether a given customer has paid, for example, property tax, water bill, solid waste bill, etc. Local ordinances could then be passed according to which a delinquent payer of any municipal services would be denied administrative procedures (for example, registering a business or issuing a permit) until the arrears have been paid. If customers have legitimate affordability concerns, direct support should be provided (see Measures 3.1-3.3) rather than allowing non-payment for services.

Enforcement mechanisms depend first of all on the billing system. Apart from information technology, the effectiveness of a billing system depends also on the billing frequency, public awareness, and revenue collection mechanisms.

While collection of waste must be an on-going activity, often ranging from weekly to more frequent collection, the frequency with which bills are issued must also be considered. In some countries (for example, the United Kingdom), where for example solid waste is paid for through a property tax, payments are made annually or in quarterly instalments. In other countries (for example, in Poland), bills for solid waste management are issued monthly. Billing frequency should be determined based on the cash flow needs of the waste collection and landfill operating companies. In Montenegro, cash flow in small PUCs may be a concern and therefore monthly bills are recommended. On the other hand, billing frequency also depends on the administrative capacity of the PUC to issue bills and collect payments. In addition, municipalities with very low revenue collection rates may not always resolve their revenue collection problems with more frequent billings.

When revenue collection rates increase (for example, to above 90%), billing frequency can be set by optimising the cash flow needs of the PUC with the administrative costs of issuing bills. This optimisation might mean that during periods of low waste generation (for example, winter), bills might be issued bi-monthly (as the expected payments do not justify the added administrative expense), whilst in periods of higher waste generation, monthly bills might be warranted.

Billing frequency is further complicated by the fact that in many cases, the municipal governments do not have accurate lists of the dwellings that are current-
ly or temporarily occupied. Under some tariff systems (such as volume-based), customers would be billed regardless of whether their dwelling is occupied year-round or at all. The fact that the dwelling is located in the service area, must have a contract for waste collection, and may contribute to the stream of solid waste at any moment upon occupation, means that the customer is still billed.

Public awareness campaigns are needed to emphasise the importance of paying for solid waste management (and other utility) services. In addition, the importance of proper solid waste disposal and treatment (that is, avoid illegal disposal and treatment) should be emphasised in such campaigns.

User charges, in whatever form, can be collected through the following means:

- Municipalities collect tariffs through existing collection systems - property taxes, electricity bills, water bills, etc.
- Municipalities collect tariffs through dedicated solid waste collection system
- Public utility companies that deal with solid waste collect tariffs through existing collection systems - property taxes, electricity bills, water bills, etc.
- Public utility companies that deal with solid waste collect tariffs through dedicated solid waste collection system
- Specialised public utility dedicated to collection of tariffs and municipal fees is used
- Private operator of collection system, based on direct contract with customers, collects directly from the customers.

The decision as to which of these mechanisms to use should be determined on a case-by-case basis according to the following factors:

- Administrative costs – the cheapest option should be chosen for an equivalent level of collection
- Revenue collection rate – options that have the best chance of increasing the revenue collection rate above 90% should be preferred, unless the administrative costs clearly indicate that they would be less effective than a cheaper solution
- Flexibility – options that can be adjusted in order to improve the collection system should be preferred. In contrast, options that “lock in” a given approach should not be pursued. Accordingly, establishing a dedicated fee collection public utility where one did not previously exist may create a bureaucracy that cannot be eliminated if it is no longer useful or adjusted to make it more effective.

Measures of enforcement and sanctions must be in place in relation to the billing system. The question is, what happens if a customer does not pay the bill? Should the municipality (i.e. the taxpayers) or the other users of the system pay the bills of those that do not pay? According to the principle of full-cost recovery, the service provider can recover losses or receivables from unrecoverable debt or delinquent payments.
In countries where long-lasting tradition of services and payments for them exist (for example, Denmark and many countries of the European Union), these questions are not vital. Such countries also have effective enforcement mechanisms, such as witholding of salaries for non-payment of public debt or suspension of services. The latter measure, however, is not feasible given that uncollected waste can constitute a public health risk.

Other enforcement measures include linking solid waste bills to other bills that are more likely to be paid, such as water bills or property taxes.

Enforcement measures also need to include environmental inspection and control to fine violators that dispose of solid waste illegally.

Priorities

While full achievement of this objective is medium-term (5-10 years), it is imperative to begin public awareness and enforcement activities as soon as possible, with implementation beginning no later than the end of 2013 in service areas where landfills are already operational and within six months of the opening of any future landfills.

Implementation of public awareness and education activities should be initiated by the end of 2013 for service areas that currently have landfills and within six months of the opening of any future landfills in service areas where such is planned.

Indicators

The following indicators are recommended to measure the achievement of Objective 1:

- number of public awareness and education activities undertaken in the municipalities of a given service area
- attendance at information events
- number of inquiries and complaints from the public
- coverage of SWM issues in local press, radio, and television
- number and size of illegal dump sites
- revenue collection rates.

7.4.2 Objective 2: Achieve financial sustainability in the provision of solid waste management services

Evidence suggests (see Chapter 6) that balancing the financial sustainability in the provisions of solid waste management services with affordability constraints could require possibly difficult policy decisions in some municipalities of Montenegro. This is due to the specific nature of the various service areas, including low population density and overall high costs of construction of sanitary landfills that serve small populations (below 100-200 thousand persons), as well as low household income in some rural areas and regions. Therefore, the achievement of financial sustainability in the provision of solid waste management services should be considered as a medium to long-term objective.

In terms of financing sources for the provision of solid waste management services, the Government of Montenegro has made explicit in its policies and statements that the collection, treatment, and disposal of solid waste should be a self-financing service. This means that the tariffs for solid waste – including all
the costs of collection and final destination of the solid waste (whether composting, landfilling, etc.) – should cover the costs of providing the service. In addition, solid waste tariffs are supposed to cover the costs of investments, for example, by including depreciation of facilities and interest payments on debt in the calculation of tariffs. The Government of Montenegro has stated it will support the development of solid waste management projects by financing studies and capacity development, as well as by incurring loans to finance investments. The costs of interest payments on debt, however, are to be included in the calculation of the cost recovery tariffs.

Full-cost recovery tariffs should be the main means of financing solid waste management services and achieving financial sustainability. Full-cost recovery tariffs are also consistent with the polluter pays principle, whereby the “waste holder shall pay the costs of waste collection, transportation and treatment in accordance with the "polluter pays" principle” and that “the costs of waste management shall be borne by manufacturers, importers and distributors of product from which the waste originates.”

Accordingly, the generators of waste – the polluters – have to pay the costs of waste collection, transport and treatment. From this, it can also be inferred that the full costs of providing waste management services needed to be covered by the available means. Full-cost recovery tariffs include several components, as presented in Table 27.

Table 27 Components of solid waste management tariff, separate for collection and disposal

<table>
<thead>
<tr>
<th>Cost components to include in the calculation of full cost recovery tariffs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy/electricity</td>
</tr>
<tr>
<td>Spare parts</td>
</tr>
<tr>
<td>Fuel</td>
</tr>
<tr>
<td>Personnel (wages and benefits)</td>
</tr>
<tr>
<td>Landfill closing and aftercare</td>
</tr>
<tr>
<td>Maintenance and repairs</td>
</tr>
<tr>
<td>Insurance</td>
</tr>
<tr>
<td>Third-party services (outsourcing)</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Depreciation</td>
</tr>
<tr>
<td>Provision for bad debt (to cover shortfalls in cash flow due to non- or late-paying customers)</td>
</tr>
<tr>
<td>Financing costs (interest on loans incurred to finance fixed assets)</td>
</tr>
<tr>
<td>Loan principal in excess of depreciation (if the amount of scheduled loan payment exceeds the calculated depreciation in the given time period, the difference (excess) should be added to the costs that need to be covered by the tariff)</td>
</tr>
</tbody>
</table>

Source: Consultants proposal

Measures

Measure 2.1. Develop “Solid Waste Tariff Setting Guidelines” for local government authorities

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9 Article 84 (1)(2) “Sources of Financing,” Law on Waste Management, passed on 23 December 2011, promulgated 27 December 2011
Local governments are responsible for municipal solid waste management, including collection, treatment and disposal. They can delegate this function to a multi-sector public utility company (PUC), a specialised PUC, a private company, or a combination. Since local governments also operate as the regulator of solid waste management services, they require capacity development to act as effective regulators.

As part of this capacity development, the Government of Montenegro shall develop Solid Waste Tariff Setting Guidelines. The Guidelines shall include the following components:

- Principles for setting solid waste tariffs
- Steps in setting solid waste tariffs.

The following principles shall guide the setting of solid waste tariffs:

- **Full-cost recovery**: tariffs must reflect the costs of providing the solid waste service, including operating and maintenance costs, as well as capital costs (investment, financing, depreciation).

- **Polluter pays**: in keeping with full-cost recovery, those responsible for the generation of waste should pay the cost of handling this waste.

- **Efficient allocation of resources**: when municipal financial resources are used inefficiently in one area, availability is lower in other areas. Thus, if resources are used inefficiently to provide solid waste management services, fewer resources will be available for other municipal services. This also means that any subsidies provided to a solid waste services provider should be deemed temporary and only used to bridge periods when costs are high and affordability low.

- **Financial viability**: the solid waste management service should be financially sustainable, meaning that either a positive cash flow is generated from the tariff, or from the tariff and any subsidies (as a last re-sort).

- **Financial and managerial autonomy**: the solid waste tariff should be a part of an overall strategy to increase the financial and managerial autonomy of the solid waste services provider(s). Financial autonomy means that the service provider can generate sufficient cash flow from the tariff to provide services of required quality and quantity. Managerial autonomy means that the service provider should be free from interference in day-to-day management decisions from the solid waste services regulator.

- **Administrative and technical feasibility**: the selected tariff should balance the administrative and technical costs of its implementation and use against the benefits from the tariff (that is, primarily revenue generated, but also incentives to reduce waste, engage in recycling and reduce illegal dumping).

- **Fairness**: tariffs are considered fair when the waste holder pays in proportion to its use of the service.
• **Affordability:** while tariffs should be fair, the ability of households to pay for solid waste tariffs should be considered, both in the context of the tariff itself, as well as against the background of other tariffs the customer must pay (for example, for water and wastewater services, heating, etc.). Regardless, even poor households should cover at least the operating and maintenance costs of providing solid waste management services.

• **Transparency:** tariffs should be understandable; in other words, customers understand what they are paying for and why they are paying it, in particular the linkage between levels of service and the cost of providing that service

• **Reduce illegal dumping:** as far as possible, the solid waste tariffs should provide incentives to reduce illegal dumping.

At least the following steps should be included and described in the “Solid Waste Tariff Setting Guidelines”:

• **Research customer base:** the dynamics of the customer base should be well understood. This includes the demographic characteristics of the service area, such as: total population, age structure of population, population drivers (birth rate, death rate, net immigration; trends in these drivers; reasons for changes), total population that is economically active, unemployment rate, structure of employment, household income divided into at least quintiles and broken down by urban and rural population, number of registered households, number of registered residential dwellings, number of registered commercial entities, number of industrial entities, number of institutional waste generators. Projections for future population should be prepared, as well as for future household income, for a period of at least 20 years.

• **Define solid waste generation rates:** based on existing national studies, or in accordance with estimates from feasibility studies covering local investments, the waste generation rates should be estimated for the service area. Future changes in solid waste generation rates should also be forecast for a period of at least 20 years.

• **Describe service levels:** the different parts of the service area should be defined in terms of: current service provider (for example, municipal PUC, private contractor, etc.), waste collection frequency, number of household customers, number of other customers.

• **Present short, medium, and long-term investment plan:** based on a review of the customer base and service levels, an investment plan needs to be prepared in which short, medium and long-term investments are covered. The plan should include expected investment and operating and maintenance costs, number of customers to be served/affected by the investment, expected environmental impact, as well as financing of the investments.

• **Describe system costs:** the costs of the various components of the solid waste management system (collection, landfill, treatment facilities, if any)
should be listed and described. The description should include a review of the main cost drivers in the areas of waste collection, treatment, and disposal, as well as the reasons for current cost levels and expected trends.

- **Review and propose institutional set-up:** the current and target institutional set-up should be described and the sustainability of this set-up demonstrated. For example, if a regional landfill operating company is established, it needs to be demonstrated how this company will operate and how it will obtain the needed level of institutional capacity effectively to function.

- **Research household affordability:** based on national and/or local studies, the maximum theoretical amount that household customers could afford to pay (for example, as a percentage of their monthly household disposable income) should be described. The examination of household affordability should be broken down by urban and rural areas, as well as by at least quartiles.

- **Identify and propose tariff basis:** the Guidelines should describe the possible tariff bases (flat-rate, variable rate, etc.) that are recommended for use. In preparing the tariff, the service provider makes a justification for selecting the tariff basis by demonstrating the approach as the most cost-effective (a qualitative analysis such as the one described in Chapter 5 may be used).

- **Calculate solid waste tariffs:** the Guidelines should describe the method by which solid waste tariffs may be calculated, including the approach for any operating subsidies to the service provider (including a plan for the phasing out of such subsidies) and support for poor customers. Service providers are then obliged to follow the same methodology in preparing tariffs.

- **Demonstrate financial viability:** assuming the tariff is implemented, it must be demonstrated that the tariff will lead to the financial viability (positive cumulative net cash flow during the planning period) for the service provider. If cumulative cash flow is negative, the method of covering the shortfall must be indicated.

- **Provide rationale for successive tariff increases:** the tariff-setting procedure should also include a forecast of future revenues and expenditures, resulting in a medium-term (five years or the length of the medium-term investment plan) tariff calculation. In order to cover costs and achieve financial viability, it must be demonstrated how the tariffs will increase over time. If affordability limits are a concern, the tariff plan should include the rationale for increasing the tariff over time in order to achieve full-cost coverage.

- **Describe tariff introduction and enactment procedures:** once the tariff has been prepared, it needs to be enacted. The Solid Waste Tariff Setting Guidelines should specify procedures for their enactment in order to have the requisite force of law. Sample drafts of local decisions enacting solid waste tariffs should be provided.
The roles and responsibilities of the national government, local government, and service providers in the implementation of each step should be described.

**Measure 2.2. Develop Solid Waste Tariff Calculation Methodology**

A tariff calculation methodology shall be developed and described, as an annex to the Solid Waste Tariff Setting Guidelines. In addition, tariff calculation aids, including an Excel-based financial model that is uniform to all municipalities, shall be developed.

**Measure 2.3. Capacity development in the use of the Guidelines and Methodology**

Once the Guidelines and Methodology have been approved, a series of workshops / trainings should be offered to municipal personnel, as well as the personnel from waste management service providers, in order to facilitate their implementation. Each municipality in Montenegro should attend at least one workshop / training.

In order to complete this measure, an institution shall be identified that will manage and conduct this capacity development. As part of its statutory activities, the same institution shall provide on-going technical assistance to municipalities and service providers in the area of tariff-setting.

**Measure 2.4. Calculate full-cost recovery tariffs**

Public utility companies responsible for solid waste management, based on the approved tariff-setting guidelines, tariff calculation methodology, and capacity development activities (Measures 2.1-2.3), prepare tariff calculations in accordance with principle of full-cost recovery. These tariffs are then submitted for approval by the local regulator (municipal government). This tariff becomes the point of discussion for implementation of a full-cost recovery tariff in the context of local affordability constraints (see Objective 3).

**Priorities**

Given that national plans for construction of regional landfills are currently being realised, the two measures (Tariff Setting Guidelines and Tariff Calculation Methodology) are of equal priority. Once both are approved, the third measure (Capacity Development) should be implemented.

**The Guidelines and Methodology should be completed and formally approved as policy by the end of 2013. The Capacity-Building component should be implemented in the first half of 2014, in order for 2015 tariffs to be calculated according to the guidelines and methodology and correspond to full-cost recovery tariffs.**

**Indicators**

The following indicators are recommended to measure the achievement of Objective 2:

- “Solid Waste Tariff Setting Guidelines” have been developed, submitted for review and consultation, and approved.
• Tariff calculation methodology, together with calculation aids, has been developed and approved

• Twenty-three municipalities, with their respective service providers, have participated in the capacity development workshops/trainings

• All Montenegrin municipalities, with their respective service providers, have calculated a full-cost recovery tariff for the provision of solid waste management services.

7.4.3 Objective 3: Implement local tariff policy that accounts for customer ability-to-pay for solid waste management services (affordability)

The objective to achieve full-cost recovery in the provision of solid waste management service needs to be balanced against the estimated ability of customers to pay for solid waste management services. This balance is not easy to achieve given that Montenegro still requires significant capital expenditures in the solid waste management sector and the low population density in many areas that will be served by regional landfills. These two factors contribute to high unit costs (per person served) of an integrated solid waste management system, involving collection and proper treatment/disposal. A national study is required on ability-to-pay (affordability) and willingness-to-pay for various service levels in key utility sectors (solid waste, water and wastewater, heating).

Measures

Measure 3.1. Conduct national study on ability and willingness-to-pay

At present, national statistics on household income are available for urban and rural areas. More detail is required in order to make adequate determinations as to whether solid waste tariffs (and other utility services) are affordable to household customers. To this end, a national study of willingness and ability-to-pay for key utility services (solid waste, water and wastewater, heating) shall be prepared. The study should have the following content:

• **Household income survey.** More detailed breakdowns of household incomes are required. These data should be collected through direct household surveys.

• **Household income forecast.** Based on various economic growth scenarios, the household income forecast should be broken down by urban/rural, region, as well as individual municipality.

• **Household budget survey.** The current methodology for conducting household budget surveys should be expanded to include specific monthly expenditures on key utility services (solid waste, water and wastewater, heating). Current data indicate that the average household in Montenegro spends 2 EUR per month on “refuse removal” and this figure has remain unchanged for the past several surveys (2008-2011)\(^{10}\). Based on available

\(^{10}\) MONSTAT
data from municipalities, this figure appears low. In addition, solid waste fees will increase as landfill and other treatment facilities are included as part of solid waste management services.

- **Service level questionnaire.** Willingness-to-pay for various service levels should be investigated. In this questionnaire, respondents are presented with various service levels and asked how much additional money they would be willing to pay (for example, per month) to achieve this level of service.

- **Affordability guidelines.** Given the lack of data on customer behaviour in the face of rising solid waste management costs, affordability guidelines will need to be set at the national level based on pre-defined income groups, such as: median household income, average household income, and household income of poorest quartile. These should be presented for both urban and rural areas, as well as by region, and preferably by individual municipality. In each case, the theoretical affordability limits should be set as a percentage of household disposable income. The range of 1-2% should be tested for solid waste management.

### Measure 3.2. Set national affordability guidelines for key utility sectors

Based on the study from Measure 3.1, national affordability guidelines for key utility sectors (solid waste, water and wastewater, and heating) should be defined. These guidelines should take the form of a national government policy for examining the affordability of key utility services.

### Measure 3.3. Implement solid waste management tariff

Public utility companies responsible for solid waste management, based on the approved tariff-setting guidelines, tariff calculation methodology, and capacity development activities (Measures 2.1-2.3), prepare tariff calculations in accordance with principle of full-cost recovery (Measure 2.4). These tariffs are then submitted for approval by the local regulator (municipal government). This tariff becomes the point of discussion for implementation of a full-cost recovery tariff in the context of local affordability constraints.

If the calculated full cost recovery tariff would exceed the assumed limits for household affordability (see Measure 3.2), a decision is needed on how to address the issue. As a PUC should operate as a commercial entity, it should be permitted to charge the tariff needed to cover its costs. If calculated full cost recovery tariffs exceed affordability limits, the following measures can be considered:

- **Do nothing** – the PUC charges, and the local regulator approves, the tariff required to cover the full costs of service provision. Customer behaviour is monitored (payments) and proper disposal of municipal solid waste is enforced.

- **Direct subsidy to households** – the municipality determines which household income groups would have difficulty paying for solid waste services (taking into account their other expenditures, in particular on other munici-
pal services) and provides direct income support to them (either directly or to the PUC on behalf of the customer). Regardless, the PUC charges the full-cost recovery tariff.

- **Cross-subsidy between customer groups or across the service area** – some customer groups can be charged higher tariffs in order for poorer households to have an affordable tariff. Customers in areas with high unit costs of services (such as sparsely populated municipalities located far from a landfill) can also be subsidised in this manner.

- **Direct transfer from the municipality to the public utility company or system operator** – in order to cover any operating deficit that arises as a result of charging lower tariffs. This method should be used as a last resort and, if it is used, should be temporary.

Targeted assistance to lower income customers, while maintaining tariffs at cost recovery levels, is preferred.

**Priorities**

Given that national plans for construction of regional landfills are currently being realised, the national survey should be completed as a priority. Once the study has been completed, the national affordability guidelines and policy should be prepared and approved.

**The national study on affordability should be completed and formally approved as policy by the end of 2013. The affordability guidelines and policy should be completed in the first quarter of 2014, in order for 2015 tariffs to be calculated according to the affordability guidelines.**

**Indicators**

The following indicators are recommended to measure the achievement of Objective 3:

- National study on ability and willingness-to-pay prepared and approved
- Affordability guidelines and policy prepared and approved
- Tariffs calculated in accordance with full-cost recovery principle and in accordance with affordability policy, if necessary, in all Montenegrin municipalities.

### 7.4.4 Objective 4: Promote financial and managerial autonomy of solid waste service providers.

Achieving financial and managerial autonomy of solid waste service providers requires an adjustment in the relationship between the service regulator (municipality) and service provider. Being able to calculate and recover the full costs of providing utility services affords the service provider financial autonomy in its operations. Managerial autonomy - being able to make strategic management decisions without direct interference from external actors - follows from financial autonomy. With managerial autonomy, service providers make decisions on the number of personnel, promotion and evaluation of employees, organizational structure, preparation and implementation of strategic and business plans, capital investment planning, tariff calculation, and many other areas.
without day-to-day interference from the local regulator (local government administration).

At the same time, the local regulator ensures that service levels are met, tariffs are calculated according to the established methodology, and the interests of poor households are protected. Equally important, however, is the monitoring function of the local regulator, according to which the municipality controls whether the service provider is meeting its strategic objectives, implementing its business plan, complying with the law, and providing adequate waste collection and/or treatment services. The local government refrains from interfering in typical management decisions, such as hiring employees, but also hires managers through competitive processes meant to identify and select the most talented and qualified general managers for the given utility.

Both parties – the service provider and the municipalities (by law responsible for providing waste services) – should benefit from this arrangement. On the one hand, the service provider can recover the actual costs of its operations, through options ranging from user charges (preferably) to from subsidies from the local government calculated to cover the actual costs of operations (only if all other options have been exhausted), as well as enjoy managerial autonomy in day-to-day operations and implementation of agreed strategic objectives. On the other hand, the local government frees up scarce financial resources that can now be spent on other sectors and investments.

The full achievement of this objective should be considered as medium-term (5-7 years).

Measures

Measure 4.1. Preparation of strategic/business plan and local solid waste management plan

The basis for planning future solid waste services should be a set of local plans that cover service provision, as well as guide the service provider to improve the cost-effectiveness of services. The local solid waste management plan is already required under the Law on Waste Management and many municipalities have up-to-date plans. The methodology used to prepare such plans, however, should undergo periodic review and improvement.

To that end, in cooperation with the local solid waste services regulator (municipality), the providers of solid waste services (including collection, treatment, and disposal) should prepare a set of strategic documents, as follows:

- Local solid waste management plan, including: list of existing and closed dumpsites, current MSW collection system, current MSW generation and composition, future waste generation and composition (based on permanent and temporary population, economic growth, and unit waste generation forecasts), and options for regulatory compliance including business-as-usual (limited investment and expansion of services), fast compliance with national and EU requirements, and cost-effective compliance with national and EU requirements. The local solid waste management plan shall be reviewed and revised no less than at five-year intervals.
• Local investment plan for solid waste management. Based on the local solid waste management plan, a local solid waste investment plan shall be prepared. Given that national policy in Montenegro is to construct regional landfills, these investment plans will be prepared for the entire service area covered by the regional landfill. Investments will be specified in the areas of collection and handling of waste (such as in material recovery facilities, by composting, landfilling, etc.) and sufficient to meet the waste management targets set out in the local solid waste management plan. The investment plan shall be reviewed and revised no less than at five-year intervals, in particular to include changes in waste flows and revisions in the expected landfill useful life.

• Strategic and/or business plan of solid waste management service provider. Each service provider shall prepare five-year strategic plan for the development of their respective services (that is, collections, landfill operation, etc.). The strategic plan shall detail plans for improving the cost-effectiveness of services, based on performance indicators. The strategic plan shall be revised on an annual basis for a rolling, five-year period.

The service providers are individually and jointly responsible for following the plans they have prepared and that have been approved by the local regulator of solid waste services. The local regulator is responsible for approving the content of the plans in order to ensure they respond to local priorities, as well as for monitoring the implementation of the plans to ensure that the objectives contained in them are achieved.

Measure 4.2. Implement performance-based contracts between municipalities and service providers

Performance-based contracts (PBCs) are intended to introduce a contractual, commercial relationship between the parties responsible for utility services (whether public-public or public-private) to replace the ad hoc, political relationships that may occur in the delivery of utility services. PBCs are also commonly used as a tool to improve public sector accountability and performance and often are required by international financing institutions (IFIs) as a precondition for awarding grants or extending loans.

Performance-based contracts allocate the rights and obligations between parties for the delivery of utility services (for example, asset management, capital investments, service payments, operating costs, service connections, service standards, etc.), as well as allocate risk and incentives and/or penalties for achieving performance targets. Performance indicators, which are used to measure attainment of performance targets and strategic objectives related to the provisions of utility services, are an important element of performance-based contracts. These targets, in turn, serve as the basis for financial incentives for PUC management and employees.

In keeping with the principles of self-financing and financial and managerial autonomy of PUCs, PBCs set out the overall targets to be achieved by the PUC, but leave the specific manner employed to achieve such results to the PUC. This a results-oriented contract compared to an arrangement focused principally on inputs and procedures. Since the PUC management’s remuneration should be
tied to their ability to meet the targets, such agreements provide an incentive for the contractor to improve its performance and efficiency.

PBCs are particularly important for utility services such as solid waste management, where responsibility for the service, tariff setting, ordering and quality control lie with the founder (the municipality), whereas the entity responsible for service provision (the PUC) and its customers (citizens) are separated. Moreover, a PBC can prepare the municipality later to monitor operating contracts (for example, with a landfill operator) with the private sector. An integral part of performance-based contracts are performance indicators.

Figure 1  Case in which PBC should be applied

In the example presented in Figure 1, municipalities have established their respective PUCs, which, among other things, provide solid waste management services. The municipality supports its PUC financially (as a last resort), as well as receives and reviews the PUCs financial and other reports. In this model, the same municipalities within a designated service area establish a regional PUC, which manages the regional landfill. The customer receives and pays for a service (payment for waste collection and disposal), but only sees the collection part of the service. Thus, the customer has little contact with the service provider(s) and has little or no idea about service levels, other than that the waste is collected at the appointed time.

Source: Consultants assessment
In this situation, a PBC can be useful to introduce a more commercial relationship in cases in which the method of providing the utility service makes a weak link between payment for services and control of service quality. If the service provider is a commercial entity with direct contact with the customer, a commercial contract with the municipality that includes performance incentives and penalties should be sufficient.

By providing a stable and predictable framework for improved governance, accountability and management, PBCs can result in improvements in the quality of service provided. In addition, over time PBCs can provide waste utilities with increased financial and managerial independence in exchange for improved service provision. PBCs provide a framework within which a PUC can reform and commercialise its operations, improve financial and operational efficiency to reduce any burden upon public finances (e.g. subsidies), and subsequently attract external finance (either public or private) for priority investment needs.

Performance-based contracts are not synonymous with, nor do they automatically lead to, private-sector participation. On the other hand, municipalities that have implemented performance-based contracts are better equipped to protect the public interest in a privatization or private-sector participation arrangement, having already worked with a public PUC under a formal contractual arrangement.

Measure 4.3. Establish performance indicators for use in solid waste management

Performance indicators are information synthesized from data and variables collected about all processes within the utility - for example, waste collection, fleet management, customer service, personnel and payroll, and financial management. Indicators are calculated from day-to-day information and variables that are needed to operate the PUC. A set of high-level indicators should be proposed, that is, those that provide an overall picture of the financial and operational performance of the utility that can be used to measure progress against predetermined targets. Performance indicators should be used to communicate synthesized information about the PUC’s progress toward meeting objectives not only to managers and their employees, but also to the municipality and even customers.

Performance indicators are ratios that are defined in order to:

- Measure improvements in the overall performance of the PUC
- Assess improvements in the levels of service provided by the PUC
- Identify any performance trends that may be appearing, e.g. increased effectiveness
- Demonstrate the overall development of the utility to its shareholders, customers, external regulators and funding agents.
Performance indicators should also be linked to the PUC’s strategy and used to measure progress toward its implementation.

Performance indicators for solid waste management can be grouped into the following categories: Staffing and productivity; System financial sustainability and Financial ratios. Sample performance indicators are provided in Annex 4.

Priorities

Given that this objective will be achieved over the medium-term, improving local planning should be the first priority. In addition, given Objective 2 (Achieve Financial Sustainability), it is equally important to have a mechanism for encouraging cost management in PUCs. Performance-based contracts should be used to provide incentives for PUCs to seek cost savings in order to remove upward pressure on full-cost recovery tariffs. Performance indicators can also be identified and implemented within the medium-term, both to provide strategic information, as well as part of national benchmarking in the solid waste sector.

Local plans mentioned in Measure 5.1 should be implemented and approved by the end of 2015. Pilot performance-based contracts should be completed and approved by the end of 2014. Performance indicators should be identified and recommended by the end of 2013, followed by a testing period, and finally inclusion in performance-based contracts by the end of 2014.

Indicators

The following indicators should be tracked to measure achievement of Objective 4:

- Strategic and/or business planning implemented in all local PUCs, as well as in landfill operating companies by 2015
- Medium-term capital investment planning implemented in all local PUCs, as well as in landfill operating companies by 2015
- Pilot performance-based contracts in three service areas by the end of 2014
- Performance-based contracts implemented between municipality and solid waste PUCs in at least 10 municipalities or regional service areas by 2016
- Set of nationally recommended performance indicators for solid waste management established by 2014.
8 Conclusions

The following tariff policy recommendations are offered:

- Affordability limits (1% of average disposable household income) are likely to be exceeded during the operating period of recently constructed and future regional landfills. It is important that municipalities and PUCs advance full-cost recovery tariffs and use policy means other than subsidies to PUCs to address affordability issues.

- Uniform SWM tariffs within particular customer groups are recommended.

- Revenue collection rates need to be brought up to a range of 90-95% on a consistent basis.

- The tariff basis for household customers is proposed to be square meter (as is currently the case), number of registered persons, number of households. Per container fees can be considered when customer databases have been updated and revenue collection rates reach 90-95% on a consistent basis. In addition, prior to implementing such a tariff basis, public awareness about SWM should be raised and customers should have viable options to reduce waste (composting, recycling, etc.), if they prove feasible.

- The tariff basis for non-household customers may be based on a per container fee.

- Customer databases require upgrading and updating, which can be done in parallel to other efforts to improve property registries, etc. Until such time as these databases are upgraded, more innovative tariff bases are not recommended.

- As an example of an innovative tariff basis, the weight-based tariff is fair, encourages waste reduction (though illegal dumping needs to be policed), and complies with the polluter pays principle. It should not be considered, however, as there are few if any known applications of this tariff basis in the world.

- In tourist areas, tariffs should be collected year-round and the tariff rates should not differ from the tourist and non-tourist season. This enables the PUC to have a more predictable cash flow, as well as provides customers with a lower monthly payment (but paid throughout the year). On the other hand, this puts less pressure on municipalities and PUCs to track occupancies of vacation properties.
Annex 1  Tariff Models

This Annex contains an overview and discussion on various tariff models. A summary of the conclusions is found in the main body of the report. This annex describes the various options for tariff-setting and cost recovery mechanisms, taking into account the principle of polluter-pays and the contracting option selected in the Activity 3 Report (Contract Options).

1 Principles for solid waste management tariffs

The principles for setting solid waste management tariffs are set out in several key documents, such as the Law on Waste Management of the Republic of Montenegro.

1.1 Polluter pays

As mentioned, the Law on Waste Management of the Republic of Montenegro establishes that the “waste holder shall pay the costs of waste collection, transportation and treatment in accordance with the "polluter pays" principle” and that “the costs of waste management shall be borne by manufacturers, importers and distributors of product from which the waste originates.”

Accordingly, the generators of waste – the polluters – have to pay the costs of waste collection, transport and treatment. From this, it can also be inferred that the full costs of providing waste management services needed to be covered by the available means.

1.2 Waste hierarchy

The Law on Waste Management of the Republic of Montenegro adopts the principle of waste hierarchy. Accordingly, the handling of waste through disposal at a sanitary landfill is the least desirable method from among those that

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are permissible under the law. The waste management hierarchy encourages the adoption of options for managing waste in the following order of priority:

- Waste should be prevented or reduced at source as far as possible.
- Where waste cannot be prevented, waste materials should be reused.
- Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material.
- Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources.
- Only if waste cannot be prevented, reclaimed or recovered, should it be disposed of into the environment by landfilling, and this should only be undertaken in a controlled manner.

This principle is further discussed in Annex 3.

1.3 Cost recovery

The principle of cost recovery holds that waste tariffs should cover the costs of solid waste management, both the collection and treatment of waste. Tariffs should cover the costs of commissioning, maintenance, repair, operation, closing down and monitoring of domestic solid waste disposal facilities using costs-based tariffs. Full cost recovery means that the operating, maintenance and capital costs (depreciation and interest payments on debt related to solid waste management investments) need to be included in the calculation of tariffs.

Accordingly, the following cost components are considered to be part of the calculation of a full-cost recovery tariff (Table 27).

Many public utility companies in Montenegrin municipalities, for example in Nikšić, include many of these elements in the calculation of the monthly costs of collecting communal solid waste (except for the loan principal in excess of depreciation and provisions for bad debt).

It also is important to point out that the collection and disposal system must include other elements as well. For example, the collection system should include the costs of transportation either to the place of final disposal (sanitary landfill or other destination set by law) or to a transfer station or intermediate treatment facility (such as a material recovery facility). Dual collection costs should also be included in collection costs. The disposal tariff should include all costs from the final disposal or treatment site (such as a landfill) or a transfer station.

From these cost elements, if applicable, the revenues from the sale of recyclables can be deducted in order to obtain the total required revenues that need to be generated in order for a tariff to be considered full cost recovery.
1.4 Self-financing and financial and managerial autonomy

Since it is a revenue-generating activity, solid waste management services should be self-financing and any operator of such a system should strive to achieve this objective. The concept of “self-financing” for revenue generating utilities is clear: user charges should cover all of the costs of providing and expanding services. No subsidies should be provided to operators of the waste system – whether collection companies or the operator of a landfill and other treatment facilities.

Financial autonomy

Just as important, the service provider (Public Utility Company, private company, or other permitted under the law) should be financially and managerially autonomous. Related to the first principle, being able to calculate and recover the full costs of providing utility services, affords the service provider financial autonomy in its operations. Managerial autonomy - being able to make strategic management decisions without direct interference from external actors - follows from financial autonomy. With managerial autonomy, service providers make decisions on the number of personnel, promotion and evaluation of employees, organizational structure, preparation and implementation of strategic and business plans, capital investment planning, tariff calculation, and many other areas without day-to-day interference from the local regulator (in Montenegro, the local government administration).

Managerial autonomy

Managerial autonomy also means that the local government assumes a regulatory function, in which it controls whether the service provider is meeting its strategic objectives, implementing its business plan, complying with the law, and providing adequate waste collection and/or treatment services. The local government refrains from interfering in typical management decisions, such as hiring employees, but also hires managers through competitive processes meant to identify and select the most talented and qualified general managers for the given utility.

Both parties – the service provider and the municipalities (by law responsible for providing waste services) – should benefit from this arrangement. On the one hand, the service provider can recover the actual costs of its operations, preferably from user charges only, as well as enjoy managerial autonomy in day-to-day operations and implementation of agreed strategic objectives. On the other hand, the local government frees up scarce financial resources that can now be spent on other sectors and investments.

1.5 Affordability

Insofar as possible, waste charges or tariffs should be affordable for household customers. This should be measured with respect to the ability of customers to pay for waste services without having to resort to coping mechanism such as non-payment of bills, illegal dumping of waste, etc. For customers from lower income groups, targeted assistance should be considered.

In keeping with the principles that the cost of providing solid waste management services should be covered through user charges and that solid waste
management services should be self-financing, tariffs need to be set at a level that covers the cost of service provision.

If the calculated full cost recovery tariff would exceed the assumed limits for household affordability (typically, 1-2% of average disposable household income), a decision is needed on how to address the issue. As a PUC should operate as a commercial entity, it should be able to use a tariff it needs to cover costs. If calculated full cost recovery tariffs exceed affordability limits, the following measures can be considered:

- **Do nothing**
- **Provide direct subsidy to poor households**
- **Provide cross-subsidy between customer groups or across the service area**
- **Direct transfer from the municipality to the public utility company or system operator.**

Targeted assistance to lower income customers, while maintaining tariffs at cost recovery levels, is preferred.

Further discussion on affordability is provided in Annex 2.

### 2 Functions of tariffs

Tariffs have several key functions, as follows:

- Efficiency function
- Revenue function
- Administrative function
- Affordability function

Each of these is discussed below. In addition, tariffs often are used to perform a social function, though this is not a proper function of tariffs. The main arguments for and against the "social" function are also discussed in this section.

In summary, a good tariff should serve four functions: it should favour economic efficiency in the delivery of the solid waste management services; it should promote financial autonomy of the service provider by covering at least the average costs of providing services; it should be affordable for all customer groups (in particular households); and it should be feasible to implement with a good administrative support system.

**Efficiency function**

The efficiency function involves calculating and charging a tariff that will ensure that customers cover the costs of supplying the service to them. By charging full cost recovery tariffs, the service provider is effectively passing the decision onto the customer as to whether the benefits of increased use of the service are worth the increased costs of supplying the service. Thus, the customer makes the decision about how much to consume and is encouraged to engage in...
rational behaviour. It is important to point out, however, that a tariff only serves the efficiency function when it is calculated based on the principle of cost recovery and if the consumption of the service can be measured (for example, using a container of a specified volume of solid waste, see section 9.4 on types of tariffs).

**Revenue function**
The revenue function involves calculating and charging a tariff that will ensure a stream of revenues sufficient to provide the service provider with a degree of financial autonomy from the owner/municipality. Through financial autonomy, a service provider can attain institutional autonomy, meaning it can focus on making business decisions to provide the best services at the lowest costs. At the same time, a service provider that is financially autonomous can also be held accountable for achieving results.

**Administrative function**
The administrative function of a tariff involves such issues as registering the consumption of the service, as well as billing and collection of revenues. The effectiveness of any tariff is only as good as the administrative support available to implement it. Since some tariff structures require measuring systems (for example, weight-based variable tariffs), it is important that in such cases the measuring must be exhaustive and then translated into correct and timely billings. Customers require prompt feedback so that they can adjust their future consumption of the waste services accordingly. The billings must be understandable to customers and collected consequently and in a timely fashion; otherwise, customers will realize that collections are not pursued and the tariff will cease to promote efficient consumption and financial autonomy of the service provider. The administrative capacity of the service provider as well as of the local municipal government to act as regulator of the service are important in determining what type of tariff can be implemented (see section 9.4).

**Affordability function**
Finally, the affordability function of a tariff deals with the affordability of services and how this impacts payment discipline. Tariffs need to be set after taking into account local income levels. If the tariff is not affordable for the poorest segments of society, they may not be able to afford the services, which could result in them using services illegally (such as disposing of solid waste in illegal dump sites). In addition, the service provider may have difficulties enforcing payment for services, may not be allowed to cut-off certain services, or may discontinue services but without the desired effect - for example, if solid waste collection services could in fact be discontinued, a former customer may burn the trash or illegally dispose of it.

**Challenges**
In examining the four functions of a tariff, some of them seem to contradict the others. For example, the efficiency and revenue functions seem to contradict the affordability function. On the other hand, the administrative function may be in contradiction to the revenue function. As a result, it is not possible to define a perfect tariff that would be completely efficient, easy to administer, affordable for customers, while at the same time maximizing revenues for the service provider. This means that the municipal government, as the local regulator of solid waste management services, must analyse the functions of a tariff in each case in light of specific local conditions and objectives and design the tariff that is best suited to local conditions.
Social function

Although it is not advisable to use a tariff as an instrument of social policy, the social function of tariffs warrants special attention. The social function involves setting the tariff for utility services at a level below the costs of the delivery of those services in order to reduce costs for customers, which means that the service provider will have to be subsidized in some way. This may take the form of an operating transfer or subsidizing capital investment expenditures or, more problematically, it may involve the service provider deferring payment of bills from its own suppliers or delaying payment of salaries to its employees.

In addition, in cases when the municipality (owner) is experiencing financial difficulties, the adequacy and timing of the subsidies may suffer, which in turn deprives the service provider of financial autonomy. The loss of financial autonomy may lead to the blurring of responsibility for services levels, which in turn leads to a decline in the effectiveness of providing these services. The end result is that the service provider also loses managerial autonomy and becomes both a financial and administrative burden to the local government, as well as an object of political manipulation. Further, if low prices are maintained, sharp increases will be required in the future (for example, due to co-financing from international institutions).

3 Financing solid waste management

In terms of financing sources for the provision of solid waste management services, the Government of Montenegro has made explicit in its policies and statements that the collection, treatment, and disposal of solid waste should be a self-financing service. This means that the tariffs for solid waste – including all the costs of collection and final destination of the solid waste (whether composting, landfilling, etc.) – should cover the costs of providing the service. In addition, solid waste tariffs are supposed to cover the costs of investments, for example, by including depreciation of facilities and interest payment on debt in the calculation of tariffs. The Government of Montenegro, however, will support the development of solid waste management projects by financing studies and capacity development, as well as by incurring loans to finance investments. The costs of interest payment on debt related to solid waste management investments, however, are to be included in the calculation of the cost recovery tariffs.

Methods of financing

The existing methods of financing solid waste management include the following:

- Local taxes, such as property tax, council tax, waste tax, etc.
- User charges, such as tariffs per unit of waste generated or some other basis
- Grants from high levels of government, for example the national government
- Grants from special purpose funds or revolving funds
- Grants from international donors
• Subsidies from local, regional, or national governments

• Revenues from the sale of recyclable materials

• Loans from the capital market or from international financing institutions such as the European Investment Bank, World Bank, European Bank for Reconstruction and Development, etc.

• Private sector participation, including public-private partnerships.

The following sections briefly review each of these financing sources.

3.1 Local taxes

Local taxes – conservation tax, property tax, council tax, or waste tax – can be used to finance solid waste management. For example, in the United Kingdom, a council tax is assessed on residential property (and thus, it is effectively a property tax) to pay for a variety of municipal services, including collection and disposal of solid waste. In Turkey, a waste tax is assessed based on household water consumption and a flat rate per cubic metre of consumption is charged.

In Poland, the system of financing solid waste management services is moving from charges per container or per household member to a solid waste tax. The basis for assessment of the tax, however, is up to the local government to determine and can be based on one of the following: number of persons registered at property, volume of water consumed at given property, surface area of housing, or flat rate per household. The proposed system also foresees payments for non-residential customers, based on the number of available containers (whether they are filled or not). At the same time, the Polish system requires local governments to hold a public tender to select a waste collection company (formally, it had been up to each customer to select a service provider from among those licensed by the municipality).

Some advantages with regard to local taxes as a source of financing solid waste management include:

• Can reduce illegal dumping of waste. In Poland, solid waste user charges have not eliminated illegal dumping of waste as in less densely populated areas, user charges were based on the amount of waste generated (measured by the number of containers) and illegal dumping continued. When an essentially flat charge is assessed, there is no incentive to dump illegally, since payments must be made regardless of waste production.

• Links tax basis to existing payment mechanisms. In Turkey, citizens are more used to and more likely to pay for water services. Linking the waste tax to payment of water bills ensures that payments are made as water supply services – theoretically – could more easily be cut-off than waste services as a penalty for non-payment. In the United Kingdom, the property tax is well understood and has been analysed in detail; people are accustomed to paying it. In Armenia, customers pay for solid waste as a percentage (2%) of their electricity bills. While there is positive correlation be-
tween electricity bills and solid waste generation, the link between the two is weak. Nevertheless, since customers can identify with electricity bills, revenue collection rates for solid waste are very high.

On the other hand, the following disadvantages of local taxes as a source of financing solid waste management include:

- The basis for the tax may not be assessed on a regular basis. Thus, if property assessments are carried out at irregular intervals, the costs of solid waste management may have changed and will not be covered from the tax. In summary, such a tax also does not increase in proportion to an increase in economic activity.

- The tax does not remove the responsibility to assess accurately the costs of providing services. For example, in Turkey, the current waste tax typically covers around 10-20% of the costs of service provision in smaller cities and towns as no link is made between actual costs and the tax rate. These costs then have to be subsidised from the municipal budget.

- Taxes can be challenged for fairness. In the United Kingdom, the council tax is widely regarded as regressive. While this tax covers other municipal services apart from solid waste management, the regressive nature of the tax means that lower income customers pay proportionately more for solid waste collection and disposal that richer customers, despite the positive correlation between income and solid waste generation.

- Taxes are information intensive. In order to implement effectively, a property registry needs to be in place and maintained on a regular basis for changes. In addition, details on the various properties are important, such as the number of residents and the amount of surface area. These data must be compared to the overall costs of providing the service.

- No direct linkage between amount of waste generated and the amount paid for solid waste management services. Local governments have a difficult task calculating the costs of service provision and translating that into a tax rate that should cover the full costs of service provision.

- Taxes do not reduce waste generation. Unless incentives are built-in – for example, by providing a discount for waste reduction and recycling activities – waste generation will not decrease, as users will realize that payments remain the same regardless of the amount of waste generated.

### 3.2 User charges

**User charges** are the most direct way for customers to pay for solid waste management services and can be assessed based on the actual amount of waste generated, which should provide an incentive to reduce waste.

Some advantages of user charges as a source of financing solid waste management include:
Familiarity. User charges are familiar to most customers since they are paid for a variety of services, including in Montenegro.

Incentive to reduce waste. If the charge is set based on the amount of waste generated (for example, measured according to the number of containers used), customers have the incentive to reduce waste (or dispose of it illegally, see disadvantages below).

Direct linkage between costs and benefits. If the costs can be accurately measured and tracked, they can be linked to the amount of waste generated and a fair system in which the polluter pays can be devised.

Direct linkage of service to service provider. If a service provider collects the user charges (for example, a private company that collects the waste), there is direct contact between the customer and the service provider. This provides an incentive to improve and maintain service levels.

On the other hand, the following disadvantages of user charges as a source of financing solid waste management include:

Information intensive. If the charge is based on the number of persons per dwelling (for example, a flat fee per person or living space), a robust system of registering persons and property is required. This system must be updated on a regular basis. If the user charge is based on the number of containers, they must be lent to customers and a contract concluded. Finally, if the charge is based on the actual volume or mass of waste generated, trucks need to be fitted with a special weighing system and these data must be integrated into a customer database.

Some user charges remove incentives to reduce waste. A flat charge per person or per cubic metre of living space does not provide any incentive to reduce waste. While incentives to separate recyclables can be built into a system – for example using a rebate for recyclables provided – the division of the rebate for the recyclables will need to be divided in an equitable manner.

Enforcement and penalties are vital components of effective user charges. A user charge based on available volume (that is, the customer pays per container, whether it is filled or not) or based on actual amount of waste produced (for example, based on either a full container or actual weighed amounts) may give an incentive to the customer to dispose of waste illegally. Therefore, such a system requires adequate enforcement and penalties for violations.

3.3 Government grants and subsidies

Grants can be provided by national or regional governments – either directly or through special purpose funds – to local governments in order to finance large investments in solid waste management (landfills, sorting stations, recycling centres, composting facilities, transfer stations, etc.). International agencies or organisations, as well as foreign governments, can also provide grants.
Subsidies can be provided by local governments to the provider of solid waste management services – for example, a local enterprise owned by the local government or a private company – in order to cover operating deficits. Operating subsidies should only be used when it can be demonstrated that the properly calculated user charges required to cover the cost of services would be higher than the assumed affordability level of such services (see Annex 2 for further discussion) and all other options have been exhausted. Preferably, subsidies can also be provided through direct, targeted assistance to customers from lower income groups in order to assist them in paying the full cost of providing the service.

The advantages of grants and subsidies for financing solid waste management include:

- Government grants used to finance infrastructure can relieve upward pressure on user charges. When a sector has been under-invested for a number of years – as in the case in the solid waste sector in Montenegro – government grants can be used to co-finance investments. This enables the investor (local government or private sector) to avoid borrowing money to finance the investments. According to the principles of full cost recovery tariffs, interest on loans should be covered through user charges.

- Grants can accelerate the pace of legal compliance. Without grants, compliance may be delayed as local governments also need to provide other key services that may have suffered similar neglect. Investments foreseen in the National Solid Waste Master Plan may also be more quickly implemented.

- Subsidies can be used to maintain affordable tariffs. If user charges are higher than affordability limits, operating subsidies can be used until household income increases.

On the other hand, the following disadvantages of grants and subsidies as a source of financing solid waste management include:

- Grants can lead to over-dimensioned investments. Unless the procedure for project development, evaluation and selection is well-developed, municipalities may have incentives to propose unnecessarily large investments in order to claim more grant money. It is important that investments be sized to meet the problem they are designed to address. In the case of solid waste management, a sanitary landfill should be designed to accommodate waste over a pre-defined period (for example, 20-30 years). If the landfill is designed for too large (or small) a population, or based on assumptions of solid waste generation that are not accurate, parts of the landfill constructed during the initial phase may fail to perform properly when they are actually needed.

- Subsidies should not be used over the long-term.
3.4 Sale of recyclable materials

Recyclable materials can be collected and sold on the market either to profit the landfill operator and/or reduce user charges.

The advantages of financing solid waste management from the sale of recyclable materials include:

- Revenues from sale of recyclable materials can be used to offset the costs of providing waste collection and treatment services. As a result, user charges can be reduced.

On the other hand, the disadvantages of financing solid waste management from the sale of recyclable materials include:

- Market uncertainty. If the market for recyclables declines – for example, due to low prices – these materials may need to be landfilled, which will decrease the lifetime of the landfill. In addition, user charges will need to increase to cover the cost of services.

3.5 Loans

Loans can be obtained from the capital market or from international financing institutions. Like grants, they are used to finance large investments in solid waste management (landfills, sorting stations, recycling centres, composting facilities, transfer stations, etc.).

The advantages of loans for financing solid waste management include:

- Loans can be used to accelerate the pace of legal compliance and overall investment. Without loans, compliance may be delayed as local governments also need to provide other key services that may have suffered similar neglect.

- Since they need to be repaid, loans provide an incentive to define the project on a scale that is actually needed. Proper procedures for project development, evaluation and selection still need to be well-developed.

- Low-interest loans can incentivise investments in priority sectors. In addition, local governments that make regular payments can have a portion of the loan principal forgiven.

On the other hand, the following disadvantages of grants and subsidies as a source of financing solid waste management include:

- Loans create upward pressure on user charges. According to the principles of full cost recovery tariffs, interest on loans should be covered through user charges.

- Loans reduce investment capacity over the medium to long-term. In exchange for increasing short-term investment capacity, local governments...
have reduced medium to long-term financing capacity due to reduced creditworthiness.

3.6 Private sector participation

Private sector participation (PSP) including public-private partnership (PPP) is often seen as a means to finance capital investment in the solid waste sector as well as to operate resulting infrastructure. There are many models of PSP; the main ones are discussed in the Procurement Options Report (see Activity 3 Report).

The advantages of financing solid waste management through private sector participation include:

- Private sector can provide investment capital, thereby freeing national and local funds to be spent in other sectors.
- Lack of local expertise can be overcome by engaging a private sector operator with experience in solid waste management.
- Private sector – if provided with adequate information – is often more efficient in the operation of solid waste management services.

On the other hand, the following disadvantages of financing solid waste management through private sector participation include:

- Private sector investors and operators require premiums for risk and uncertainties. As shown in the Procurement Options Report (Activity 3 Report), high levels of uncertainty and high probability of risk occurrence will mean that private sector investors would likely be more expensive service providers than traditional means of investment and operation (i.e., based primarily on national capital and capacities).
- Involving the private sector in the provision of solid waste management services – in particular landfill operation and management – requires robust datasets, in particular on the amounts and types of waste generated based on empirical data.
- Involving the private sector requires a high level of regulatory and oversight capacity at the local level. Local government officials or employees of entities in charge of overseeing landfill operations (such as Budoš from Nikšić) need to have the capacity to understand, monitor, and react to the activities and decisions of the private sector party in order best to represent the interests of their constituents.

3.7 Conclusions for Montenegro

Due to its relatively small population, the unit cost of landfill construction (for example, per capita served or per tonne of solid waste landfilled) will tend to be high. Municipal financing capacity, on the other hand, is not sufficient. There-
fore, the financing of regional landfill investments should be borne primarily by the national government, using a mixture of grants and loans. Operation and maintenance of facilities (landfills and other facilities) should be financed through user charges, loans and grants.

4 Types of user charges

In keeping with the principles for financing of solid waste management in Montenegro set out in the Law on Waste Management, user charges will be the main form of financing investments in solid waste infrastructure, as well as the operation and maintenance of this infrastructure. To that end, the following section covers various options for types of user charges.

The following types of tariffs for private households and commercial and public institutions and other producers of waste are considered:

- Flat rate tariffs – based on unit waste generation, number of registered inhabitants, transport distances, seasonal variations, and socio-economic circumstances
- Variable rate tariffs – including weight based and volume based tariffs.

Each one of these is considered in turn.

In general, tariffs can be of the flat rate type or variable. Under flat rates, users must pay a charge irrespective of the amount of waste the user actually produces or disposes of in the waste management system. A variable rate structure means that the actual charge imposed on the user reflects the use of the service offered. Both types are compatible with the polluter pays principle and can be used to recover the full costs of the waste management system. Their differences lie in the areas of impacts and fairness of the tariffs.

Hybrid rates are also possible, in which a customer pays a fixed rate (for example, to cover administration) and a variable rate based on actual use of the system.

4.1 Flat-rate tariff

A flat-rate tariff for solid waste management services is a fee charged to customers irrespective of actual use of those services. At the same time, this means that the individual user has unlimited use of the services and pays the same fixed amount of money.

While the flat rate links payment with the actual service – collection and treatment or disposal of waste - and thereby provides a signal to the waste producers that there are costs associated with the treatment and disposal of waste, it does not provide any incentives for the user to reduce usage of the service. Since the user pays the same amount regardless of the amount of waste generated, waste streams are unlikely to be affected. In fact, the opposite effect may occur in that once a customer pays for the service he/she uses it as much as possible.
A flat-rate system will not encourage recycling activities because the fixed, flat rate has to be paid regardless of the level of recycling the customer undertakes. In the flat-rate system, separation of waste streams by the customer and recycling activities rely on voluntary behaviour, as the customer cannot reduce the waste bill through these activities.

The following advantages of the flat-rate tariff for waste services are noted:

- **Transparency** – Flat rate charges are easy to understand and calculate. This requires, however, that the flat rate includes pre-determined cost items. The company engaged in waste collection would require clear guidelines on how to calculate the collection charge. Likewise, the entity engaged in operating the landfill and other disposal facilities would require clear guidelines on how to calculate the gate fee. These guidelines should be uniform and transparent.

- **Predictable revenue stream** – In a flat-rate system, customers (individual households, commercial enterprises, etc.) need to be required by law to use the local service in the area where they reside (or own property, in the case of a summer home). Given the number of waste producers and the unit price for waste collection, the revenue is relatively easy to forecast. As the charge is fixed, all bills issued are the same and a waste management company can forecast revenues from waste services and plan expenditure accordingly. The effectiveness of revenue collection also needs to be taken into account.

- **Ease of administration and enforcement** – A flat-rate system is simple to administer, as it involves the number of customers times the flat rate per customer. Close monitoring of usage and service levels are not required. Flat rates are relatively easy to enforce by associating the duty of paying the charge to the property owner.

The following disadvantages of the flat-rate tariff for waste services are noted:

- **Fairness** – In practice, if a flat rate for solid waste services is charged for all customers over a given service area, some households, especially in rural municipalities, may claim that they will not fully use the waste management system and that it is not fair to impose a fixed, flat rate on all households. Some households, in turn, may not be able to pay the charge. The reverse argument of fairness can also be valid. If all customers pay the same rate within a given service area, households from more densely populated areas may effectively subsidise waste services in sparsely populated areas where unit costs of collection are higher.

- **Lack of incentives** – integrated solid waste management in accordance with the Waste Framework Directive, as well as the Law on Waste of the Republic of Montenegro requires reductions in the waste stream that is landfilled. Flat rates provide no inherent incentive to reduce waste streams
4.2 Variable-rate tariff

Essentially, variable-rate charges include volume-based and weight-based systems. This means that the actual fee paid by the individual household reflects its actual or potential use of the service.

Bills issued to each individual waste producer (or property owner) in a volume-based system will, to some extent, reflect the volume that the particular user has available. In other words, the user pays according to the available volume of waste storage containers, i.e. the user's potential to make use of the system. Another key component of this system is the frequency of waste collection. In a weight-based system, the actual waste production is measured (weighed) and the bill to the waste producer (or property owner) reflects the amount of waste that enters the waste collection and treatment system.

When applying variable rates – whether volume-based or weight-based – the actual bill can reflect the volume or weight of the waste to a varying degree. A solid waste bill can contain a fixed component, which is not dependent on the actual usage, in order to cover fixed costs. At the same time, a waste bill also contains a variable component that is relative to the variable costs of the system. If a significant portion of the bill is fixed, the customer does not have much influence over the magnitude of the bill for solid waste.

4.3 Variable-rate tariff, volume-based

A volume-based tariff is a type of variable system in which a customer pays based on the volume that the customer can use.

A number of options exist for implementing volume-based systems in practice. Usually, the utility company can offer households/customers bins of varying capacity and set annual charges accordingly. The numbers of different bins are often limited to simplify the billing system and to prevent frequent change of bins. Each customer can then order a set of bins and waste collection frequency that best meets its needs, for example:

- One small container (e.g. 120 litres) for small households, for example collected once per week
- Two small containers (or one container, but a total of 240 litres) for a medium-sized household (or for smaller households with reduced collection frequency – for example, twice per month)
- One medium-sized container (e.g. 360 litres) for medium-sized to large households
- One small and one medium-sized container (total of 480 litres) or two medium-sized containers (total of 720 litres) for large individual households
- Large containers (for example, one or more units of 1100 litres, or larger, each) for multi-storey buildings, for example collected twice per week.
In such a payment scheme, a unit size could be established, such as 100 litres. The fee for a small container (120 litres) would then equal 1.2 of the unit price, a medium-size container would be charged 3.6 times the unit price, and so on.

Using metal or plastic bins means that waste can be containerised for longer periods between collection, thereby reducing collection costs. Collection can be done either by emptying the bin each time a waste truck.

In the Montenegrin municipalities examined for this report, 110, 1100 and 5000 litre containers were most typical, with some individual bins of 80 litres used in small municipalities.

A volume-based system can also be based on tagged bags. In this case, the waste is placed in bags that are set out for collection at fixed collection days. The bags are marked with tags indicating that the user has prepaid for the service. Alternatively, specially manufactured refuse bags with printed identification can be used. In such a system, there is a direct connection between the payment and the usage of the system (pay-as-you-throw) and thus a relatively strong incentive to minimise waste compared to the system that applies solid containers.

Since with tagged bags solid bins are not used, collection must frequently take place. A system based on tagged bags, however, require more administrative effort. This is because the effectiveness of the system in ensuring that the polluter pays is wholly dependent upon the efficiency with which collection crews check that only tagged bags are collected. The efficiency of the system can vary and the percentage of bags collected that are not tagged can be high. Therefore, authorised retailers would be needed to sell the tags.

Volume-based charges for solid waste services are the prevailing system in most Western European countries. Typically, they involve a system in which the bin is emptied each time a collection is scheduled, regardless of whether it is full. The fixed payment is made irrespective of the degree to which the bin has been filled. Waste collection frequency typically varies from two times per week to twice per month.

The following advantages of the volume-based variable tariff for waste services are noted:

- **Fairness** – Volume-based tariffs are paid in proportion to their potential impact on the waste management system. In practice, this means that the customer has access to a certain volume (for example, a 120 litre capacity container for a single-family home, collected once per week) and may use up to this amount during a given collection period; it does not necessarily mean the customer will dispose of this amount.

- **Linkage between costs and services** – Volume-based tariffs provide a signal to customers (waste producers) that there are costs associated with the treatment and disposal of the waste. The signal can also be sent to the customer that the cost depends on the container size and waste collection frequency.
• **Incentive for recycling** – Volume-based rate systems provide moderate incentives for recycling initiatives by encouraging and rewarding participation in recycling programmes. The user might select a waste container of a smaller volume because alternative ways of disposing the waste are available (free of charge). This is provided the user actually has the possibility of selecting a custom-fit bin.

• **Some incentive for waste reduction** – Since the waste producer knows the precise volume of waste that may be disposed of between collection dates (when the bin is emptied), the customer can try to limit the amount of waste to correspond to the pre-determined size of the bin in order not to pay extra for the given billing period. Furthermore, the customer can apply to use a smaller bin that accommodates a smaller waste stream.

• **Predictable revenue stream** – In a volume-based system, the number of customers and the number of their containers are known. Therefore, revenue is relatively easy to forecast. The effectiveness of revenue collection also needs to be taken into account.

• **Ease of administration and enforcement** – A volume-based system is simple to administer, as it involves the number of customers times the rate per unit of volume times the collection frequency (for example, per 100 litres). Close monitoring of usage and service levels are not required. These rates are relatively easy to enforce by associating the duty of paying the charge to the property owner that is leasing the waste container.

The following disadvantages of the volume-based variable tariff for waste services are noted:

• **Waste reduction incentives are weak** – Since a customer has access to a given amount of services (a given volume per collection period), once a volume-based rate is paid it does not provide a very strong incentive for the user to reduce usage of the service, and the waste stream is thus only affected moderately.

• **Illegal dumping** – A volume-based fee system also presents a potential drawback: the system may encourage illegal dumping and other ways of disposing of waste because in order to save money it is possible to select a waste storage container that is evidently too small compared to the need.

• **Transparency** – In the volume-based system, the charge is less transparent than in the flat rate system. This depends on the number of available containers and the degree to which the user can influence the size of the bill.

### 4.4 Variable-rate tariff, weight-based

In a weight-based system, the actual waste production is measured (weighed) and the bill to the waste producer (or property owner) reflects the amount of waste produced. In order to implement weight-based systems for household waste, on-truck weighing must take place. This means that standardised storage
containers must be used and the truck must be equipped with scales and electronic registration system. Furthermore, the billing system must be computerised in order to be able to accommodate the input data and issue the bill accordingly. This prevents most municipalities and service providers from using the system.

Such a system is more typical for commercial and industrial waste where waste is delivered in large quantities. It may involve on-board weighing or the use of a weighbridge at the landfill by which it is possible to determine the weight of a specific load of waste. In such cases it is relatively easy to establish a relationship between the user, the weight of the load, and the bill. Its use for household tariffs is essentially unknown and should not be applied in Montenegro.

The following advantages of the weight-based variable tariff for waste services are noted:

- **Fairness** – Weight-based tariffs are paid in direct proportion to their potential impact on the waste management system and the environment. Each user pays exactly according to the burden placed on the system.

- **Linkage between costs and services** – Weight-based tariffs provide a signal to customers (waste producers) that there are costs associated with the treatment and disposal of the waste.

- **Incentive for recycling** – Weight-based rate systems provide incentives for recycling initiatives by encouraging and rewarding participation in recycling programmes. The less waste handed over for ordinary collection and the more handed over for recycling, the lower the bill.

- **Incentive for waste reduction** – Since the waste producer knows that the bill can be reduced by reducing the amount of waste submitted for disposal, there is an incentive to reduce waste. At the same time, this assumes that the waste is disposed of in a legal manner.

The following disadvantages of the weight-based variable tariff for waste services are noted:

- **Incentives for illegal dumping** – Since a customer can directly reduce the waste bill by reducing the mass of waste for collection, there is an incentive to engage in illegal dumping and other ways of disposing of the waste in order to save money.

- **Lack of transparency** – In the weight-based system, the charge is not transparent since it depends exclusively on the weighing that takes place on the truck with only limited possibilities for the user to control.

- **Complexity** – In order to implement weight-based systems for household waste, on-truck weighing must take place. This means that standardised storage containers must be used and the waste truck must be equipped with scales and an electronic registration system. Furthermore, the billing system must be computerised in order to be able to accommodate the input data and issue the bill accordingly. This requires a large initial investment.
and on-going investment in human-resource capacities to manage the system; this may prevent most municipalities and service providers from using it until the required capacities are increased.

5 Implementation of user charges and revenue collection systems

Two additional important aspects to consider when selecting the proper tariff system are how they will be implemented and then collected.

5.1 Implementation

Apart from the basis of the tariff, several other aspects related to implementation need to be determined. These include decisions on: legal requirements, uniform versus differentiated tariffs, degree of cost recovery, affordability, and billing and payment.

Legal requirement

All households, commercial enterprises, and other generators of solid waste should be required by law to have a contract for collection and treatment of waste. The municipality or PUC that collects the waste then has a contract with the landfill operator for disposal of waste; this cost the PUC passes on to the customer. Some commercial and industrial enterprises will have a contract directly with the landfill operator and only pay a gate fee for disposal of the type of waste that is permitted at the landfill.

Uniform versus differentiated tariffs

Regardless of the determination of the type of fee (flat or variable rate), it must also be decided whether to apply uniform fees throughout the service area (that is, no variations between municipalities, urban areas, or rural areas) or differentiated fees reflecting variations in collection and transport costs between the various municipalities and even reflecting differences between towns, settlements and villages within each municipality. The current practice in Montenegro is to have fees set by each municipality for collection by a public utility company. Once a regional landfill is operational, however, uniform rates may be charged throughout the service area covering both collection and disposal. Alternatively, differentiated tariffs may be charged for both collection and disposal; for the latter, the charge could be based on the proportion of waste that is generated from a specific part of the service area (for example, a municipality).

Ultimately, the issue of whether to charge uniform or differentiated tariffs for collection and disposal is one of fairness. With differentiated tariffs, customers in sparsely populated municipalities and rural areas in general will likely pay higher tariff rates than customers in urban areas. At the same time, with uniform tariffs, customers in urban municipalities may subsidise the tariffs of those in rural areas by keeping them lower than they would be if those customers had to cover the costs of services themselves.

Aside from the fairness issue, uniform tariffs are easier to administer than differentiated tariffs.
Affordability

While affordability can refer to household and non-household customers, household customers are of primary concern. Affordability is measured as the percentage of household budget devoted to a particular utility service. While it should be measured empirically (see Annex 2), as a short-cut most national and local policy-makers in Europe use a figure between 1-2 per cent of average household disposable income as an indicator of affordability. If a household has to devote a percentage of its disposable income to solid waste services in excess of the assumed affordability limit, it can be expected that the household will engage in “coping mechanisms,” including late or non-payment of bills, illegal treatment of solid waste (for example, uncontrolled burning), or illegal disposal.

Affordability needs to be considered and monitored by the local regulator of utility services (the municipality). Unfortunately, detailed data on household income by region and municipality is not currently available in the Montenegrin national statistics.

Cost recovery

Insofar as possible, all costs associated with the collection and treatment or disposal of waste should be covered by the generators of that waste. Foremost among the costs that must be covered are the operating and maintenance costs of the collection and treatment/disposal systems. In addition, the generators of waste should also cover the capital costs of the solid waste management system, as well as the closure and aftercare costs of the landfill. These costs also include administration of the waste collection and disposal system, including billing and collections.

Billing and payment

As part of its solid waste master plan, Montenegro is making investments in regional landfills and operating companies, such as Budoš in Nikšić, have been established to operate the regional landfills. This raises issues on which entities will issue bills to customers for waste services. According to existing practices, a public utility company issues bills to customers for collection services and in all municipalities apart from Podgorica, no tariff is currently issued for disposal in landfills.

According to the model recommended in the Activity 3 Report, until uncertainties about waste streams for landfilling and recycling are removed, it is unlikely that the private sector would be interested in operating a regional landfill in Montenegrin municipalities (except Podgorica, which is suitably large), much less constructing it. Therefore, the most likely scenario is that customers enter into a contract with a collection company (the municipal multi-purpose public utility company) for collection and disposal of waste while the PUC has a contract with the regional landfill operator. Under this system, household customers pay bills directly to the PUC and this covers also the landfill costs. Some commercial and industrial customers may have a contract directly with the landfill operator for disposal of waste that is permitted at the landfill.

Foremost, a billing system requires a customer registry that is capable of supporting various tariff basis. At minimum, the registry should record the number of dwellings at the customer (that is, whether the customer is a single-family household, a multi-unit dwelling, commercial enterprise, etc.). The number of persons per customer (for example, number of persons in a multi-unit dwelling) can also be tracked, although a billing system based on the number of persons
requires updating each time the number of residents changes and requires integration with municipal registries of the population. For a volume-based tariff, the number and volume of containers registered to a particular customer, as well as the frequency at which the waste is collected, need to be tracked.

Property owners are the natural customers for the billing system and they should be registered as the responsible user, that is, the person who is obliged to pay the bill. Usually, this responsibility is related to the ownership of property. In the case of multi-unit dwellings, the customer is the owner or administrator (or association of owners) of the housing estate that needs to pay the waste bill; the payments of the individual tenants to the owner/administration is an internal matter of the housing estate. The billing system should also take advantage of other registers, e.g. real estate registers by which the responsible customer may be identified.

5.2 Revenue collection

Billing frequency While collection of waste must be an on-going activity, often ranging from weekly to more frequent collection, the frequency with which bills are issued must also be considered. In some countries (for example, the United Kingdom), where for example solid waste is paid for through a property tax, payments are made annually or in quarterly instalments. In other countries (for example, in Poland), bills for solid waste management are issued monthly.

Billing frequency should be determined based on the cash flow needs of the waste collection and landfill operating companies. In Montenegro, cash flow in small PUCs may be a concern and therefore monthly bills are recommended. On the other hand, billing frequency also depends on the administrative capacity of the PUC to issue bills and collect payments. As detailed in the report, some of the municipalities have very low revenue collection rates and more frequent billings may only exacerbate their revenue collection problems.

When revenue collection rates increase (for example, to above 90%), billing frequency can be set by optimising the cash flow needs of the PUC with the administrative costs of issuing bills. This optimisation might mean that during periods of low waste generation (for example, winter), bills might be issued bi-monthly (as the expected payments do not justify the added administrative expense), whilst in periods of higher waste generation, monthly bills might be warranted.

Billing frequency is further complicated by the fact that in many cases, the municipal governments do not have accurate lists of the dwellings that are currently or temporarily occupied. Under some tariff systems (such as volume-based), customers would be billed regardless of whether their dwelling is occupied year-round or at all. The fact that the dwelling is located in the service area, must have a contract for waste collection, and may contribute to the stream of solid waste at any moment upon occupation, means that the customer is still billed.

Enforcement Measures of enforcement and sanctions must be in place in relation to the billing system. The question is, what happens if a customer does not pay the
bill? Should the municipality (i.e. the taxpayers) or the other users of the system pay the bills of those that do not pay? According to the principle of full-cost recovery, the service provider can recover losses or receivables from unrecoverable debt or delinquent payments.

In countries where long-lasting tradition of services and payments for them exist (for example, Denmark and many countries of the European Union), these questions are not vital. Such countries also have effective enforcement mechanisms, such as withholding of salaries for non-payment of public debt or suspension of services. The latter measure, however, is not feasible given that uncollected waste can constitute a public health risk.

Other enforcement measures include linking solid waste bills to other bills that are more likely to be paid, such as water bills or property taxes.

Enforcement measures also need to include environmental inspection and control to fine violators that dispose of solid waste illegally.

**Public awareness**

Public awareness campaigns are needed to emphasise the importance of paying for solid waste management (and other utility) services. In addition, the importance of proper solid waste disposal and treatment (that is, avoid illegal disposal and treatment) should be emphasised in such campaigns.

**Collection mechanisms**

User charges, in whatever form, can be collected through the following means:

- Municipalities collect tariffs through existing collection systems - property taxes, electricity bills, water bills, etc.
- Municipalities collect tariffs through dedicated solid waste collection system
- Public utility companies that deal with solid waste collect tariffs through existing collection systems - property taxes, electricity bills, water bills, etc.
- Public utility companies that deal with solid waste collect tariffs through dedicated solid waste collection system
- Specialised public utility dedicated to collection of tariffs and municipal fees is used
- Private operator of collection system, based on direct contract with customers, collects directly from the customers.

The decision as to which of these mechanisms to use should be determined on a case-by-case basis according to the following factors:

- Administrative costs – the cheapest option should be chosen for an equivalent level of collection

- Revenue collection rate – options that have the best chance of increasing the revenue collection rate above 90% should be preferred, unless the administrative costs clearly indicate that they would be less effective than a cheaper solution

- Flexibility – options that can be adjusted in order to improve the collection system should be preferred. In contrast, options that “lock in” a given ap-
proach should not be pursued. Accordingly, establishing a dedicated fee collection public utility where one did not previously exist may create a bureaucracy that cannot be eliminated if it is no longer useful or adjusted to make it more effective.
Annex 2  Affordability

An essential part of the design of solid waste management tariffs is their affordability to customers, in particular households.

Affordability problems have emerged with the reduction in public subsidies for communal services. This process has come into conflict with the former understanding of utility services as social entitlements for which the state charged a symbolic fee. Persistently low tariffs have combined with the financial crises at national and local government levels, meaning that local governments are experiencing or will experience problems bridging the gap between the actual production costs of communal services and collections on customer bills.

Affordability can be viewed from several perspectives: residential customers, commercial customers, and institutional customers. For local governments and public utility companies, the most crucial aspect of affordability affecting the financial viability of PUCs are residential customers and this is the focus of this section.

1.  Estimating affordability

Underlying affordability are two key questions: is the customer able to pay (ability-to-pay)? and will the customer pay (willingness-to-pay)? Ability-to-pay (ATP) deals with the question as to whether a household's income is sufficient to pay for the services without seriously affecting their ability to pay for other essential goods and services. A household is considered unable to pay when payment for utility services would require a substantial reduction of other essential expenditures. Ability-to-pay is measured empirically using actual consumption data (for which universal metering is essential).

Willingness-to-pay

Willingness-to-pay (WTP) is the maximum amount a customer would be willing-to-pay for a given number of units of a service of given quality. In addition, willingness-to-pay for improvement in quality can indicate the maximum amount a household would be prepared to pay for better quality. Willingness-to-pay analysis is based on subjective statements of households and their judgment about their income, the quality and the price of the service.

WTP describes the customer's preferences with respect to changes in the quality of utility services and prices for these services. Therefore, willingness-to-pay analysis aims to estimate the share of customers willing to pay more for better services or to prevent deterioration of service quality in the future. There are two widely accepted methods that may be used to assess household willing-
ness-to-pay more for improved utility services: revealed preference and stated preference.

Revealed preference\textsuperscript{13} reflects actual observed behaviour in response to a change in quality of service and is based on the price elasticity of demand and income elasticity of demand. This method, however, is really only possible for service levels that are measured (for example, households paying a weight-based tariff for solid waste, or if customers have a choice between services of different quality; in these cases there is a direct relationship between changes in demand and price). On the other hand, it is not possible to calculate elasticity for households paying a flat rate by income or price because they have only two options: (a) to pay bills or (b) to refuse payment and possibly cease receiving the service, which is unlikely in solid waste management due to public health concerns. If customers pay based on a per person or per square meter norm, the revealed preference technique cannot be applied.

The method of stated preference aims to identify the share of households that are willing to pay more for better services, based on the results of customer surveys. This can be based on an assessment of the current burden of payment using macroeconomic data, that is, by calculating the share of average utility costs in the average household budget at the level of society as a whole. This assessment can also be made based on microeconomic data, by calculating the share of utility costs in the income of individual households or groups of households (such as deciles or quintiles, regions or cities, family types such as social security recipients).

\textsuperscript{13} Price elasticity of demand measures the responsiveness of the quantity of service demanded to a change in its price. It is found by observing the percentage change in quantity demanded in response to a one percent change in price. It is also the slope of the demand curve (see below) and is found by dividing the change in the quantity the consumer demands by the change in the price. For most services, as the price increases the demand for that service will decrease; thus, utility services have a negative price elasticity of demand.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{demand_curve.png}
\caption{Demand Curve}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{income_curve.png}
\caption{Income Curve}
\end{figure}

Income elasticity of demand measures the responsiveness of demand for a service to a change in the real income of the customer demanding the service. It is found by observing the percentage change in demand to the percentage change in income. It is also the slope of the income-demand curve and is found by dividing the change in the quantity the consumer demands by the change in consumer's real income. For most services, as income increases the demand for that service will also increase. This also depends, however, on whether the service is considered inferior to substitutes, if such exist. The demand for an inferior service - one for which perceived superior alternatives exist - will decrease as real income increases. Most utility services should exhibit a positive income elasticity of demand.
2. Affordability thresholds

The most typical method of estimating affordability is through the use of thresholds above which it is theorized that customers will not pay, or will have to engage in “coping mechanisms,” which in the case of solid waste, include reducing waste production, illegal dumping, and incineration. While these thresholds are based on some empirical evidence, for the most part they are accepted without critical review in many countries with different income distribution and consumption patterns.

The affordability threshold for solid waste services generally ranges from 1-2 per cent of average disposable household income. While this threshold provides a convenient decision rule that above these percentages customers will have difficulty paying for services, the fact that solid waste prices may be below these levels does not mean that no problems exist. The use of such an indicator for decision-making could be misleading, as it may hide serious income distribution disparities. Indeed, it does not reflect a possible simultaneous price rise for other essential goods and services (e.g., increase in tariffs for gas and electricity), in which case even a 1% burden may be too high.

These thresholds are one of the main evaluation tools for feasibility studies prepared in support of applications for financing from the EU and other donors and creditors. Yet, few if any country-specific studies are undertaken to see if this affordability level is really acceptable.

According to the European Union guidelines, the tariff system should at least cover operating and maintenance costs as well as a significant part of the assets’ depreciation. To that end, an adequate tariff structure should be envisaged attempting to maximize the project’s revenues before public subsidies, while taking affordability into account.

3. Affordability in Montenegro

The household budget surveys for Montenegro\(^{14}\) contain information on household income and expenditures, among others for the category “housing, water and electricity” (see Table 28).

In addition, the household budget surveys report the amount that households spend on “refuse collection” (which, according to the survey, has remained at 2 EUR per household per month in each year from 2009-2011). According to this information, households spent an average of about 0.33% of income on refuse collection for the country overall, about 0.28% in urban areas, about 0.45% in rural areas, and 0.29% in Podgorica.

\(^{14}\) Household Budget Surveys, 2005-2011, MONSTAT.
Table 28  Household income and expenditures, 2005-2011

<table>
<thead>
<tr>
<th>Year</th>
<th>Montenegro</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Household income (EUR)</td>
<td>% expenditure on “housing, water and electricity”</td>
<td>Household income (EUR)</td>
</tr>
<tr>
<td>2005</td>
<td>459</td>
<td>12.1</td>
<td>474</td>
</tr>
<tr>
<td>2006</td>
<td>444</td>
<td>12.5</td>
<td>461</td>
</tr>
<tr>
<td>2007</td>
<td>568</td>
<td>12.1</td>
<td>594</td>
</tr>
<tr>
<td>2008</td>
<td>607</td>
<td>11.0</td>
<td>669</td>
</tr>
<tr>
<td>2009</td>
<td>633</td>
<td>13.1</td>
<td>752</td>
</tr>
<tr>
<td>2010</td>
<td>588</td>
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<td>674</td>
</tr>
<tr>
<td>2011</td>
<td>606</td>
<td>14.1</td>
<td>701</td>
</tr>
</tbody>
</table>

Source: MONSTAT

According to these data, households spend a small fraction of monthly income on solid waste management services. Data from the three study areas, however, suggest that these rates will need to be much higher once regional landfills become operational.

Until a specific household survey of willingness to pay and affordability is conducted that covers various utility services in a single study, it is recommended the thresholds between 1 and 2 per cent of average disposable household income be used as a benchmark affordability limit for solid waste. At the same time, the percentage impact on median household income and the poorest income quintile should be tracked.

If the calculated full cost recovery tariff would exceed the assumed limits for household affordability (typically, 1-2% of average disposable household income), a decision is needed on how to address the issue. As a PUC should operate as a commercial entity, it should be able to use a tariff it needs to cover costs. If calculated full cost recovery tariffs exceed affordability limits, the following measures can be considered:

- **Do nothing** – the PUC charges, and the local regulator approves, the tariff required to cover the full costs of service provision. Customer behaviour is monitored (payments) and proper disposal of municipal solid waste is enforced.

- **Direct subsidy to households** – the municipality determines which household income groups would have difficulty paying for solid waste services (taking into account their other expenditures, in particular on other municipal services) and provides direct income support to them. Regardless, the PUC charges the full-cost recovery tariff.

- **Cross-subsidy between customer groups or across the service area** – some customer groups can be charged higher tariffs in order for poorer households to have an affordable tariff. Customers in areas with high unit...
costs of services (such as sparsely populated municipalities located far from a landfill) can also be subsidised in this manner.

- **Direct transfer from the municipality to the public utility company or system operator** – in order to cover any operating deficit that arises as a result of charging lower tariffs. This method should be used as a last resort and, if it is used, should be temporary.

Targeted assistance to lower income customers, while maintaining tariffs at cost recovery levels, is preferred.

In summary, Montenegrin municipalities should implement:

- Cost recovery tariffs for solid waste management, with an aim toward establishing full-cost recovery tariffs
- Affordability policy based on local assessment of income levels, with emphasis on the poorest quintile and, if necessary, with targeted, direct subsidies for them
- Policies to increase collection rates for solid waste management services, with emphasis on information campaigns and court collection procedures.

### 4. Affordability tables from quantitative analysis

In this section, the complete tables with affordability thresholds according to various tariff bases presented in Chapter 6 are presented.
Table 29  
Option I: Affordability ratios for urban HHs, 2012-2027

<table>
<thead>
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</thead>
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<td>1.76%</td>
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<td>0.58%</td>
<td>0.68%</td>
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<td>1.17%</td>
<td>1.13%</td>
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<td>1.02%</td>
<td>0.99%</td>
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<td>0.91%</td>
<td>0.86%</td>
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<td>0.86%</td>
</tr>
<tr>
<td>Zabljak</td>
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Source: Model calculations.

Table 30  
Option I: Affordability ratios for urban HHs, 2028-2043

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<td>0.81%</td>
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<td>0.76%</td>
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Source: Model calculations.
Table 31  Option I: Affordability ratios for rural HHs, 2012-2027

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<td>0.66%</td>
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<td>0.83%</td>
<td>0.79%</td>
<td>0.74%</td>
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<td>1.33%</td>
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<td>0.79%</td>
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<td>1.14%</td>
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<tr>
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<td>0.80%</td>
<td>0.83%</td>
<td>0.79%</td>
<td>0.74%</td>
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<td>1.14%</td>
<td>1.22%</td>
<td>1.17%</td>
</tr>
<tr>
<td>Pljevlja</td>
<td>%</td>
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<td>0.75%</td>
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<td>1.61%</td>
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<tr>
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<td>0.94%</td>
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Source: Model calculations.

Table 32  Option I: Affordability ratios for rural HHs, 2028-2043

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<tr>
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<tr>
<td>Savnik</td>
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<tr>
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<tr>
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<td><strong>Union (PZ)</strong></td>
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Source: Model calculations.
### Table 33: Option II: Affordability ratios for urban HHs, 2012-2027

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Source: Model calculations.

### Table 34: Option II: Affordability ratios for urban HHs, 2028-2043

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Source: Model calculations.
### Table 35: Option II: Affordability ratios for rural HHs, 2012-2027

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Source: Model calculations.

### Table 36: Option II: Affordability ratios for rural HHs, 2028-2043

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Source: Model calculations.
### Table 37  Option III: Affordability ratios for urban HHs, 2012-2027

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<td>3.54%</td>
<td>3.51%</td>
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<td>2.30%</td>
<td>2.26%</td>
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Source: Model calculations.

### Table 38  Option III: Affordability ratios for urban HHs, 2028-2043

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<th>2032</th>
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<th>2041</th>
<th>2042</th>
<th>2043</th>
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<td>0.58%</td>
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<tr>
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<td>2.40%</td>
<td>2.37%</td>
<td>2.34%</td>
<td>2.31%</td>
<td>2.28%</td>
<td>2.26%</td>
<td>2.14%</td>
<td>2.10%</td>
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<tr>
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<tr>
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Source: Model calculations.
## Table 39  
**Affordability ratios for rural HHs, 2012-2027**

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</table>

Source: Model calculations.

## Table 40  
**Affordability ratios for rural HHs, 2028-2043**

| Municipality | Unit | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Niksic       | %    | 1.01%| 0.97%| 0.94%| 0.91%| 0.87%| 0.84%| 0.82%| 0.69%| 0.65%| 0.63%| 0.61%| 0.57%| 0.54%| 0.52%| 0.50%| 0.48%|
| Pluzine      | %    | 3.33%| 3.27%| 3.23%| 3.18%| 3.13%| 3.08%| 3.04%| 2.87%| 2.82%| 2.78%| 2.74%| 2.68%| 2.63%| 2.59%| 2.56%| 2.52%|
| Savnik       | %    | 2.45%| 2.42%| 2.40%| 2.37%| 2.34%| 2.31%| 2.29%| 2.13%| 2.09%| 2.07%| 2.05%| 2.01%| 1.98%| 1.96%| 1.94%| 1.92%|
| **Union (NPS)** | %    | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |
| Pljevlja     | %    | 1.54%| 1.37%| 1.33%| 1.29%| 1.25%| 1.21%| 1.17%| 1.15%| 1.14%| 1.20%| 1.17%| 1.14%| 1.10%| 1.06%| 1.02%| 1.00%|
| Zabljak      | %    | 0.73%| 0.72%| 0.70%| 0.69%| 0.68%| 0.66%| 0.65%| 0.65%| 0.65%| 0.70%| 0.69%| 0.68%| 0.67%| 0.66%| 0.64%| 0.63%|
| **Union (PZ)** | %    | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |
| Bar          | %    | 1.16%| 1.14%| 1.11%| 1.12%| 1.10%| 1.08%| 1.05%| 1.03%| 0.87%| 0.85%| 0.83%| 0.81%| 0.80%| 0.78%| 0.77%| 0.68%|
| Ulcinj       | %    | 1.61%| 1.58%| 1.55%| 1.55%| 1.52%| 1.49%| 1.46%| 1.43%| 1.21%| 1.19%| 1.16%| 1.14%| 1.12%| 1.09%| 1.07%| 0.96%|
| **Union (BU)** | %    | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |

Source: Model calculations.
### Table 41: Option IV: Affordability ratios for urban HHs, 2012-2027

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Source: Model calculations.

### Table 42: Option IV: Affordability ratios for urban HHs, 2028-2043

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<td>1.92%</td>
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Source: Model calculations.
### Table 43: Option IV: Affordability ratios for rural HHs, 2012-2027

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Source: Model calculations.

### Table 44: Option IV: Affordability ratios for rural HHs, 2028-2043

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Annex 3  Waste Hierarchy

As discussed in the main text, an underlying key principle in the implementation of solid waste tariffs is the “waste hierarchy.” In order to ensure a common understanding of this principle, waste hierarchy is summarised in this annex.

The waste management hierarchy identified in the Waste Framework Directive\(^\text{15}\) is used as a primary tool for assessing the best practicable environmental option for the management of the sludge. This hierarchy, shown in the figure below, provides a model for a strategic and sustainable approach to waste management, giving a series of prioritised options for waste reuse, recovery or where necessary, disposal. For example, the hierarchy is reflected in the European Union’s target to reduce final waste disposal by 20% by 2010 compared with 2000 and by 50% by 2050. To do this, the EU prepared a strategy setting the following priorities: (a) prevention of waste; (b) waste recovery through, reuse, recycling and energy recovery; (c) improved treatment conditions; (d) regulation of transport.

The principle of waste hierarchy has been transposed into Montenegrin legislation\(^\text{16}\). A depiction of the waste hierarchy is presented in Figure 2.

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\(^{16}\) Article 4(5), Law on Waste Management, passed on 23 December 2011, promulgated 27 December 2011.
The waste management hierarchy encourages the adoption of options for managing waste in the following order of priority:

- Waste should be prevented or reduced at source as far as possible.
- Where waste cannot be prevented, waste materials should be reused.
- Waste materials should then be recycled or reprocessed into a form that allows them to be reclaimed as a secondary raw material.
- Where useful secondary materials cannot be reclaimed, the energy content of waste should be recovered and used as a substitute for non-renewable energy resources.
- Only if waste cannot be prevented, reclaimed or recovered, should it be disposed of into the environment by landfilling, and this should only be undertaken in a controlled manner.

Based on this hierarchy, the medium-term goal of the EU waste management policy is to ensure that only non-recoverable waste and inert waste will be accepted in landfills, which are designed and operated with appropriate levels of environmental protection for the particular type of waste. Other principles fundamental to EU waste management policy are the principles of proximity and self-sufficiency, the producer responsibility and the polluter pays principle, i.e. that waste should be disposed of in one of the nearest appropriate installations, and that the costs for disposal shall be borne by the waste producers.
Annex 4  Performance Indicators for Solid Waste Management

The following performance indicators should be considered for use in the local monitoring and regulation of solid waste management services:

1. **Staffing and productivity performance indicators**

The purpose of these indicators is to measure the productivity of the utility and its staff. PUCs should provide increasingly higher levels of service with fewer employees. This is done not simply by making employees redundant, but by developing human capital (highly trained and motivated staff), information capital (modern information systems), and organizational capital (well-designed organizational structure and working procedures).

- **Total staff per 1000 population served (no. / no.)**

  This is a measure of the productivity of the utility. Total staff should be measured as all employees of the utility allocated to solid waste management (in full-time equivalents). The population served should be the population with solid waste collection (utility customers and all residents of their dwellings).

- **Total staff per km² of area served (no. / km²)**

  This is a measure of the productivity of the utility. Total staff should be measured as all employees of the utility allocated to solid waste management (in full-time equivalents). The service area should be the geographic area served, in square kilometres.

- **Total staff per 1 ton of solid waste collected (no. / ton)**

  This is a measure of the productivity of the utility. Total staff should be measured as all employees of the utility allocated to solid waste management (in full-time equivalents). Solid waste collected is measured in tons.

- **Total distance trucks passed per 1000 population served per collection (km/no./no)**

  This is a measure of the productivity of the utility. Total distance trucks travel (including the entire fleet devoted to solid waste collection) is found
from the registries of vehicle miles travelled of the period (month, quarter, year). The population served should be the population with solid waste collection (utility customers and all residents of their dwellings). The number of collections is the number of pickups of solid waste over the period (month, quarter, year).

- **Total distance trucks passed to collect solid waste from 1 km² of service area (km / km²)**

  This is a measure of the productivity of the utility. Total distance trucks travel (including the entire fleet devoted to solid waste collection) is found from the registries of vehicle miles travelled of the period (month, quarter, year). The service area should be the geographic area served, in square kilometres.

- **Total distance trucks passed to collect 1 tonnes of solid waste (km / t)**

  This is a measure of the productivity of the utility. Total distance trucks travel (including the entire fleet devoted to solid waste collection) is found from the registries of vehicle miles travelled of the period (month, quarter, year). Solid waste collected is measured in tons (in the same period as the vehicle miles travelled).

- **Staff working hours per 1 tonnes of solid waste collected**

  This is a measure of the productivity of the utility. Total staff working hours should be measured as the actual gross working hours (including breaks and overtime). Solid waste collected is measured in tons (in the same period as for the staff working hours, that is, month, quarter, year).

2. **System sustainability indicators**

System sustainability indicators give an indication of the sustainability of the operations of the PUC. Some of those that should be considered are given below.

- **Operating costs per 1000 population served (EUR / no)**

  This is a measure of the financial stability of the utility. Total operating costs include the fixed and variable costs of providing solid waste collection services. This should also include overhead costs. It does not include capital costs, which are defined as depreciation and interest payments on loans taken out for the purpose of financing capital infrastructure investments. The population served should be the population receiving solid waste collection services (utility customers and all residents of their dwellings).

- **Operating costs per 1 tonnes of solid waste collected (EUR / t)**
This is a measure of the financial stability of the utility. Total operating costs include the fixed and variable costs of providing solid waste collection services. This should also include overhead costs. It does not include capital costs, which are defined as depreciation and interest payments on loans taken out for the purpose of financing capital infrastructure investments. Solid waste collected is measured in tons (in the same period as for the operating costs, that is, month, quarter, year).

- **Unit revenue (revenues collected from all sources / total volume of solid waste collected) (EUR / tonnes)**

  This is a measure of the financial stability of the utility. The revenues are from all sources related to providing solid waste collection services. Solid waste collected is measured in tons (in the same period as for the revenues, that is, month, quarter, year).

- **Unit operating costs (operating costs / total volume of solid waste billed) (EUR / t)**

  This is a measure of the financial stability of the utility. Total operating costs include the fixed and variable costs of providing solid waste collection services. This should also include overhead costs. It does not include capital costs, which are defined as depreciation and interest payments on loans taken out for the purpose of financing capital infrastructure investments. The total volume of solid waste billed is the total tons of solid waste collected, as reported in customer bills (in the same period as for the operating costs, that is, month, quarter, year).

- **Operating cost coverage (%)**

  This indicator shows what percentage of operating costs is covered by revenues. In order for the utility to avoid current or future financial difficulties, this ratio should be above 100%.

- **12-month collection ratio (%)**

  This is the preferred indicator of the collection rate. It is found by dividing the total amount of revenue collected (for waste management services only) by the total amount billed. In order for the collection rate to provide a reliable indicator of the effectiveness of collecting on bills, the same period should be compared. That is, revenues collected that were due in previous periods should be excluded from this measure. The target for this ratio should be 95%.

- **Affordability ratio (%)**

  This is the percentage of disposable household income that residential customers spend on solid waste management services. The general rule of thumb is that this figure should not exceed 1-2% for an average household.
3. **Financial indicators**

Financial indicators give an indication of the financial health of the PUC. Some of those that should be considered are given below.

- **Debt service coverage ratio**

  Also known as the debt service coverage ratio, this indicator is the ratio of cash available for debt servicing to interest and principal payments. In general, it is found by:

  \[
  \frac{\text{annual net income} + \text{depreciation}}{\text{principal repayment} + \text{interest payments}}
  \]

  It is generally accepted that this ratio should be around 1.3. This indicator is widely used by donors and international financial institutions to test whether the debtor will be able to repay its loans.

- **Debt ratio**

  This is the proportion of debt the utility has relative to its total assets. It is found by dividing total debt by total assets. The debt ratio is an indicator of the utility's financial risk. A value greater than 1 indicates that the utility has more debt than assets; conversely, a debt ratio of less than 1 indicates that the utility has more assets than debt.

- **Debt to equity ratio**

  This is found by dividing the utility's total liabilities by stockholders' equity. It provides an indicator of what proportion of equity and debt the utility is using to finance its assets.

- **Current ratio**

  This is found by dividing the utility's current assets by its current liabilities. It is a liquidity ratio that measures the utility's ability to pay short-term obligations. The higher the current ratio, the more capable the utility is of paying its obligations. A ratio under 1 suggests that the utility may have difficulty paying off its obligations if they came due at that point.

- **Quick ratio**

  This ratio - also called the "acid-test ratio" - is an indicator of a utility's short-term liquidity. It measures the utility's ability to meet its short-term obligations with its most liquid assets. The higher the quick ratio, the better is the utility's position. It is found by subtracting inventories from current assets and dividing the result by current liabilities.
• **Fixed assets ratio**

This ratio - also called "fixed asset turnover" - is an indicator of a utility's ability to generate net sales from fixed asset investments (property, plant and equipment), net of depreciation. It is found by dividing net sales by the next fixed assets.

• **Profitability (Gross Profit Margin)**

This is calculated by subtracting the costs of providing the solid waste services from total revenue and dividing the result by the revenue.

• **Return on assets (%)**

This is calculated by dividing net income by total assets. This indicator gives an idea as to how efficient the utility is at using its assets to generate earnings.

• **Asset turnover**

This is calculated by dividing revenues (sales) by total assets. This indicator measures the utility's efficiency at using its assets to generate revenue.

• **Average collection period (days)**

This is calculated by multiplying the number of days in the period (for example, 365 for a year) by the average amount of accounts receivables over the given period and dividing the result by the amount of credit sales (for PUC, total sales of solid waste management services). This is the approximate amount of time that it takes for the utility to receive payments owed, in terms of receivables, from its customers. The shorter period, the better.

• **Return on capital (ROC)**

This is calculated by dividing EBIT (earnings before interest and taxes) by the total of assets minus cash and investments minus non-interest bearing liabilities.

• **Average payment period (days)**

This is the number of days it takes for the utility to pay off credit purchases. It is found by dividing accounts payable by (total annual purchases / 365).