TARIFF ANALYSIS OF WASTE COLLECTION AND DISPOSAL CONCEPT IN THE MUNICIPALITY OF BIHAC

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INTRODUCTION

Waste - one of the main environmental issues in Bosnia and Herzegovina due to:

1. Inadequate management
2. Lack of infrastructure
3. Social attitude towards waste

Considerable quantities of waste dumped illegally at roadsides, in rivers, abandoned mines, and similar places, posing threats to public health and the environment.
BACKGROUND
THE MUNICIPALITY OF BIHAC

- Situated in northeastern part of Bosnia and Herzegovina (and Federation of BiH)
- The largest municipality in Una-Sana Canton
- Currently - 59 settlements, 35 local communities
- Population is 60,991, with 16,940 households and 1,644 registered commercial users
- Administrative, economic and cultural center is town of Bihac
- Environmentally sensitive area (National Park UNA)

The Municipality of Bihac

The town of Bihac
WASTE COLLECTION

Waste collection coverage 85%

Urban area – on daily basis
Semi urban and rural area - weekly
EXISTING WASTE STREAM

- Waste from households
  - Municipal waste: 27% (68% of 100%)
  - Waste from production: 73% (32% of 68%)
- Waste from industry
  - Secondary material: 21% (79% of 32%)
- Healthcare waste
  - Municipal waste: 99% (30% of 30%)
  - Medical waste: 1% (70% of 1%)

Landfill Gorjevac-Kruskovaca (or city sewage network)

Storage, incineration or is autoclaved until final disposal
In order to define the needs and expenses, generated waste amount for the period of 20 years was calculated. Estimates state amounts of 1,985,163 m$^3$ or 1,039,814 tons of waste.
METHODOLOGY
PHASED APPROACH

Phase 1

CURRENT STATE
Data collection and analysis of current state in waste management in Bihac (waste collection coverage, demography, population growth, households, number of bins and coverage, waste collection frequency, etc.)

Phase 2

DIFFERENT SYSTEM SCENARIOS ANALYSIS AND EVALUATION
System scenarios are developed based on the data obtained from the previous phase. In order to select the most suitable scenario techno-economic criteria are used.

Phase 3

FINANCIAL ALTERNATIVES FOR THE SELECTED SYSTEM
Focused on financial analysis i.e. tariff analysis of selected waste collection and handling scenario. Parameters considered:
- Collection and recycling rates for different waste types
- Infrastructure and equipment investments
- Seasonal income variation coefficient
- Operation costs (amortization, salaries, maintenance, etc.)
TECHNO-ECONOMIC CRITERIA

Waste amount and type

Waste collection
- Waste collection coverage
- Transport route optimisation
- Waste transport vehicles
- Selective waste collection

Selection and treatment
- Determination of optimal location
- Technical components of RD
- MBT
- Investment and operation costs

Final disposal
- Remediation and closure of existing landfill
- Cleanup of dump sites
- Establishment of new sanitary landfill
- Investment and operational costs

Prevention
- Public awareness campaign

Information system
- Monitoring and data processing

Investment and operation costs

Scenario 1

Scenario 2

Scenario n

Determination of most appropriate scenario
RESULTS
### SCENARIOS COMPARISON AND SELECTION

**Scenario 1**
- Development of existing system considering already defined service frequency and collection of all mixed waste.

**Scenario 2**
- This scenario implies combined solution i.e. bins placed in front of individual bins, eco islands, and one recycling yard.

**Scenario 3**
- Implies establishment of primary selection system at source, including four different bins for the selection of most economic waste based on production and mixed waste.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
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<tbody>
<tr>
<td>EU requirements</td>
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<td>Introduce of sequential costs</td>
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<td>Possibility of fast change of selecting type of waste</td>
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<td>Benefits in terms of the introduction of the concessionaire</td>
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<td>Benefits in terms of maintenance of container capacity</td>
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<tr>
<td>Benefits in terms on payment rates</td>
<td>x</td>
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</tbody>
</table>
Financial analysis for Scenario 2
ASSESSMENT OF PROFITABILITY

Assumptions:

- Expenses directly bound to the considered project were considered (observed separately from the expenses of public utility in charge)
- Financial analysis did not include expenses of disposal at the sanitary landfill, which is expected to be constructed in the future
COSTS AND REVENUES

Assumptions:
- Commissioning of sanitary landfill in 2013
- Tipping fee is 40 KM/tonne of waste
Population of the Municipality of Bihac is 60,991, with 16,940 households and 1,644 registered commercial users;

- The current solid waste management (SWM) services coverage is 85% (out of 16,942 households, 13,601 have a contract for waste collection services);
- The current payment rate is 82%;
- The plan is to achieve SWM service coverage of 100% until 2012, and to increase the payment rate up to 95% (the last also applies to commercial customers);
- The current tariff for households is 6.28 KM without VAT;
- Mean annual revenue from commercial users is 315 KM/year excluding VAT;
- Tipping fee for waste disposal on sanitary landfill is 40 KM per tonne of waste;
- Tipping fee for waste incineration is 150 KM/tonne of waste
BASIC ALTERNATIVE

Assumptions:
- Tariffs for households 6.28 KM
- Tipping fee is 40 KM/tonne of waste – since 2013

Investments:
- Purchase of new collection equipment
- Purchase of new waste bins
- Equipment for recycling yard...

Introduction of tipping fee for waste disposal
Investments 2011, 2013, 2016
ALTERNATIVE 1

Accumulated cashflow

<table>
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<tr>
<th>Year</th>
<th>Total income</th>
<th>Total expenses</th>
<th>Accumulated cashflow</th>
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<td>2020</td>
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Rehabilitation of existing municipal landfill included

Assumptions:

- Public utility company pays for sanitation and closure of existing landfill
- Tariffs for households changes from 6,28 KM to 9 KM in 2012
- Tipping fee is 40 KM/tonne of waste – since 2013
- Rehabilitation of existing dumpsite in 2013

NPV = 54.071
...ALTERNATIVE 1a

Assumptions:

- Tariffs for households changes from 9 KM to 9.3 KM in 2015

NPV = 211.900
ALTNERATIVE 2

The existing landfill is remediated and closed by municipal funds

Assumptions:
- Tariff for household changes from 6.28 KM to 8 KM in 2012;
- Tipping fee for waste disposal on sanitary landfill of 40 KM per tonne of waste is introduced in 2013;
- The Municipality needs to rehabilitate and close the existing landfill from its own resources (the Municipality can look for World Bank or other IFI/donor loans/grants)

NPV = -324.120
Assumptions:

✓ Tariff for household changes from 8 KM to 9.0 KM in 2015;

NPV = 201.977
Waste incineration

Assumptions:
- Tariff for household remains 6.28 KM;
- Tipping fee for waste incineration of 150 KM per tonne of waste is introduced in 2013 (it has to be noted that this fee is significantly lower than the European average);

NPV = -19.138.710
Assumptions:

- Tariff for households changes from 6.28 KM to 32 KM in 2013;

**NOTE:** The tariff of 32 KM per month for waste management services is too high for the population’s standard of living.

NPV = 898.695
CONCLUSIONS
Conclusions

A selection of the most appropriate scenario of waste management system in the Municipality of Bihac as well as the model of financing the selected scenario was presented.

Based on comparative analysis, Scenario 2 of the waste management system development is evaluated as the most appropriate according to the determined selection criteria.

Scenario 2 development model which consists of a combined solution, i.e:
- set of bins placed in front of individual buildings,
- containers for mixed waste provided for collective housing
- a determined number and capacity of green islands (for collection of recyclables)
- a recycling yard

Model of financing the selected system (Scenario 2) is presented in three alternatives.

Alternative 3 which included the financing of waste treatment plant was deemed inadequate and unsustainable. The remaining two alternatives imply approximately the same tariffs, with different periods of raising their value and from techno-economic aspect they are considered acceptable.
Thank you!

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