Application of MFA as a decision support tool for waste management in small municipalities – case study of Serbia

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Goal of the project?

Waste management

- OPTIMIZATION -

SYSTEMS

Waste water management
Material Flow Approach?

Waste management systems

Waste → Waste water
Off gas
Solids

Waste
Goal oriented decisions?

Available technology treatments

Legislation (EU Hierarhy)

- Protection of mankind and the environment
- Conservation of resources
- Sustainable waste management

„Economic boundaries = Affordability of waste management“
Selection of municipalities?

- **Krupanj**
  - 20191 st.
  - Region-Loznica

- **Bela Crkva**
  - 20688 st.
  - Region-Vršac

- **Aleksandrovac**
  - 23971 st.
  - Region-Kruševac

- **Svijalnac**
  - 33097 st.
  - Region-Lapovo

- **Kuršumlija**
  - 20688 st.
  - Region-Niš
Application of MFA for model development

Input:
- Waste generators
- Collection and transport
- Waste treatment

IV: Emissions & recyclables
- Regional waste management center
- Stock

DATA?

I: MSW
II: Agriculture waste
III: Industry waste

Recyclables
Data

Waste → MSW → 4 seasonal measurements
Waste water → Measurements → Quantity, Quality
Agriculture → Calculation
Industry → Questionaries
Waste generation measurements

**Waste Quantity**

- Disposal of measured waste
- Perform in period of one week i.e. when whole municipality was covered by collection

**Waste Composition**

- Samples collection (3 zones x 500kg)
- Measuring of each category
- Manual sorting (15 fractions)

Performed in 4 seasons

Implemented by:
Scenario development

Critical assessment of status quo

- Population under organized waste collection system
- Waste separation activities on a very low level
- No energy recovery from the waste
- Direct landfiling of biodegradable waste fractions without any pretreatment
- Unappropriate landfill practice (landfill gas, leachate)
Scenario development

- **Scenario 1** – waste transportation to the Regional center
- **Scenario 2** - waste separation plant and transport into the Regional center
- **Scenario 3** – waste separation plant, and composting plant
- **Scenario 4** – separation plant, anaerobic digestion and composting plant

- Primary selection of recyclable materials -
Scenario I
Scenario II
Scenario III
## Collection system - A

<table>
<thead>
<tr>
<th>Waste category</th>
<th>Wet bin</th>
<th>Dry bin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garden waste</td>
<td>95%</td>
<td>5%</td>
</tr>
<tr>
<td>Other biodegradable waste</td>
<td>85%</td>
<td>15%</td>
</tr>
<tr>
<td>Paper</td>
<td>30%</td>
<td>70%</td>
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<tr>
<td>Glass</td>
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<tr>
<td>Cardboard</td>
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<tr>
<td>Composite materials</td>
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<tr>
<td>Metals – packaging and other</td>
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<td>70%</td>
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<tr>
<td>Aluminum cans</td>
<td>30%</td>
<td>70%</td>
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<tr>
<td>Plastic packaging waste</td>
<td>30%</td>
<td>70%</td>
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<tr>
<td>Plastic bags</td>
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<td>30%</td>
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<tr>
<td>Other plastic</td>
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<td>Textile</td>
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<td>Leather</td>
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<td>Fine elements</td>
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Criteria's for evaluation

- GHG emissions
- Energy consumption
- Energy production
- Recycling rate
- Landfill volume
- Mass of landfilled organic waste
- N Leachate to the hydrosphere
- Economical feasibility - costs
Criteria's for evaluation - Results

![Bela Crkva Criteria Graph](image-url)
Summary and conclusion

- Data collection
- Scenario development
- Evaluation of developed scenarios and future perspectives

„Scenario analysis before making any new decisions in waste management“
THANK YOU!
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„NOVI SAD“ SERBIA

FORWARD TOGETHER
UNITING IDEAS FOR SUCCESSFUL WASTE MANAGEMENT SOLUTIONS