Work Programme - Waste Data Gathering and Analysis at Ciangir Landfill in Tasikmalaya
Approaches to a technical optimization in waste management

1. Overview

2. Questionnaire and sampling on site

3. Manual sorting and sample analysis

4. Results: Non-technical and technical findings

5. Technical concept

6. Recommendations
# Approaches to a technical optimization in waste management

## 1. Overview

## 2. Questionnaire and sampling on site

## 3. Manual sorting and sample analysis

## 4. Results: Non-technical and technical findings

## 5. Technical concept

## 6. Recommendations
1. Overview
1. Overview

Phase/Steps

Survey → Analysis → Results → Technical concepts → Implementation

Non-technical findings

Interview – Local informal sector
Waste sampling
Literature review

Option E → Option D → Option C → Option B → Option A

Technical findings

Option A
Option B
Option C
Option D
Option E

Waste components
Dry matter
Leachate water

...
Approaches to a technical optimization in waste management

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2. Questionnaire and sampling on site

• Questionnaire and sampling on site are necessary to do in order to achieve a valid and up-to-date information, e.g. condition of the existing landfill, people factor, etc.

• The information is useful to determine what solution can be offered, such as waste logistic and type of waste treatment technology.

• Questionnaire and sampling are usually listed in a survey form.

• Survey form covers information relating to the general aspect, waste logistic, on site visual inspection and sorting analysis of waste
2. Questionnaire and sampling on site

A. General Data
   - Time and date
   - Team: preparedness by PPE and health condition
   - Area to prepare and separate sample

B. Truck Arrival
   - Truck: amount, route or pick-up points
   - Net loading weight of waste

C. Material Arrival
   - Duration of homogenisation
   - Hazardous waste (household, industrial and medical) in truck batches
   - Other irregularities

D. Material Arrival
   - Net weight of reduced sample

E. Manual sorting and waste analysis

Sorted weight
- Paper/paperboards
- Plastics
- Organics
- Textiles
- Metals
- Glass
- Rubber
- Hazardous waste
- Inerts
2. Questionnaire and sampling on site

Waste sampling on site
1. Waste is unloaded from arriving truck
2. Waste load is mixed by an excavator in Area A
3. The 10% of mixture is moved to a second free area (Area B)
4. Area A is cleared by an excavator
5. Mixed sample after 24 hours can be obtained for hand-sorting
2. Questionnaire and sampling on site

Sampling on site
2. Questionnaire and sampling on site
2. Questionnaire and sampling on site
Approaches to a technical optimization in waste management

1. Overview
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5. Technical concept
6. Recommendations
3. Manual sorting and sample analysis

Mixed waste in Area B

Commercial waste

Market waste

Household waste

Heap 1

Heap 2

Heap 3

Organics

Inorganics

Hand sorting

Transportation

Hand sorting
3. Manual sorting and sample analysis
3. Manual sorting and sample analysis
3. Manual sorting and sample analysis

Manual sorting
3. Manual sorting and sample analysis
3. Manual sorting and sample analysis

Manual sorting
3. Manual sorting and sample analysis
3. Manual sorting and sample analysis

Samples → Waste

Dry matter analysis → Waste composition analysis → Analysis

Water

Mixed paper
Cardboard
Multi layer material

Paper/paperboards

Pet
Ps
Others

Plastics

HDPE
PP
LDPE
PMMA

Organics

Textiles

Metals

Fe
NFE (ex. Al cans)
NFE (Al cans)

Glass

Rubber

Hazardous waste

Inerts

COD
BOD
TS
Total N
Metals
T
pH

Concentration

Fractional weight
Approaches to a technical optimization in waste management

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4. Results: Non-technical and technical findings

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6. Recommendations
### 4. Results: Non-technical and technical findings

#### A. General Data
- **Time and date**
  - Survey: 02-07-2018
  - Sample prep: 11-07-2018
- **Team**
  - PPE: safety shoes, working pants, safety gloves, particle filter mask
  - Pre-health check: OK
- **Area**
  - Area A: (20 x 20) m²
  - Area B: (40 x 40) m²

#### B. Truck Arrival
- **Truck**
  - HW: 39 trucks
  - MW: 12 trucks
  - CoW: 13 trucks
- **Route**
  - No GPS or paper based collection route

#### C. Material Arrival (Waste visual inspection)
- **Duration of homogenisation**
  - 20 minutes
- **Hazardous waste** (household, industrial and medical)
  - Not found
- **Other irregularities**
  - Not found

#### D. Material Arrival (Waste sorting analysis preparation)
- **Net weight of reduced sample**

#### E. Manual sorting and waste analysis
- Paper/paperboards
- Plastics
- Organics
- Textiles
- Metals
- Glass
- Rubber
- Hazardous waste
- Inerts

---

*HW: household waste; MW: market waste; CoW: commercial waste*
## 4. Results: Technical findings

<table>
<thead>
<tr>
<th>TRUCK NUMBER</th>
<th>HOUSEHOLD WASTE</th>
<th>MARKET WASTE</th>
<th>COMMERCIAL WASTE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Net loading</td>
<td>Reduced sample</td>
<td>Net loading</td>
</tr>
<tr>
<td>1</td>
<td>1320</td>
<td>490</td>
<td>3140</td>
</tr>
<tr>
<td>2</td>
<td>2920</td>
<td>155</td>
<td>3210</td>
</tr>
<tr>
<td>3</td>
<td>2790</td>
<td>155</td>
<td>2890</td>
</tr>
<tr>
<td>4</td>
<td>1300</td>
<td>155</td>
<td>2620</td>
</tr>
<tr>
<td>5</td>
<td>1920</td>
<td>155</td>
<td>3100</td>
</tr>
<tr>
<td>6</td>
<td>2590</td>
<td>223</td>
<td>2680</td>
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<td>7</td>
<td>2250</td>
<td>224</td>
<td>2700</td>
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<td>8</td>
<td>2830</td>
<td>224</td>
<td>2400</td>
</tr>
<tr>
<td>9</td>
<td>3470</td>
<td>500</td>
<td>2850</td>
</tr>
<tr>
<td>10</td>
<td>1430</td>
<td>500</td>
<td>2770</td>
</tr>
<tr>
<td>11</td>
<td>4070</td>
<td>500</td>
<td>2570</td>
</tr>
<tr>
<td>12</td>
<td>3630</td>
<td>550</td>
<td>2360</td>
</tr>
<tr>
<td>13</td>
<td>2310</td>
<td>285</td>
<td>1100</td>
</tr>
<tr>
<td>14</td>
<td>2650</td>
<td>285</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>2090</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>3190</td>
<td>335</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>4220</td>
<td>335</td>
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<tr>
<td>18</td>
<td>3320</td>
<td>640</td>
<td></td>
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<td>19</td>
<td>2730</td>
<td>640</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>3560</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Results: Technical findings

D. Material Arrival (Waste sorting analysis preparation)

- Net weight of reduced sample

E. Manual sorting and waste analysis

Sorted waste for analysis
Leachate water for analysis

<table>
<thead>
<tr>
<th>Waste Type</th>
<th>Sorted Weight</th>
<th>Leachate Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household waste</td>
<td>6,851 kg</td>
<td>5,609 kg</td>
</tr>
<tr>
<td>Market waste</td>
<td>2,360 kg</td>
<td>1,776 kg</td>
</tr>
<tr>
<td>Commercial waste</td>
<td>2,740 kg</td>
<td>2,357 kg</td>
</tr>
</tbody>
</table>
4. Results: Technical findings

**Sorted waste for analysis: Overall**

- **Household Waste**
  - Mixed textiles: 19.58%
  - LDPE: 10.46%
  - Organic waste (putrescibles): 50.18%

- **Market Waste**
  - Mixed textiles: 5.04%
  - LDPE: 7.64%
  - Organic waste (putrescibles): 79.45%

- **Commercial Waste**
  - Mixed textiles: 12.15%
  - LDPE: 8.76%
  - Organic waste (putrescibles): 60.76%

- **Urban waste**
  - Mixed textiles: 17.7%
  - LDPE: 10.1%
  - Organic waste (putrescibles): 53.2%

- **Mixtures**
  - Mixed Paper
  - HDPE
  - PMMA
  - Mixed textiles
  - Mixed glass (not clear)
  - Medical waste
  - Cardboard
  - LDPE
  - Others
  - FE
  - Tires, rubber products
  - Stones, concrete, soil/clay
  - Multi-layer material
  - PS
  - Putrescibles (excluding garden)
  - NFE (aluminum cans)
  - Liquid or solid hazardous waste
  - PET
  - PP
  - Putrescibles (garden)
  - NFE (excluding aluminum cans)
  - WEEE
4. Results: Technical findings

Sorted waste for analysis: Inorganics
4. Results: Technical findings

Comparison of materials in sorted waste

Organics | Mixed paper | Cardboard | Multi-layer material | PET | HDPE | LDPE | PS | PP | others | Textiles | Fe | Glass | Rubber

Household waste:
- Organics (HoW): 53%
- Mixed paper (HoW): 18%
- Cardboard (HoW): 29%
- Multi-layer material (HoW): 2%
- PET (HoW): 12.4%
- HDPE (HoW): 8%
- LDPE (HoW): 15.6%
- PS (HoW): 17.4%
- PP (HoW): 56%
- others (HoW): 26.6%

Market waste:
- Organics (MW): 79.6%
- Mixed paper (MW): 12.4%
- Cardboard (MW): 8%
- Multi-layer material (MW): 8%
- PET (MW): 15.6%
- HDPE (MW): 20.1%
- LDPE (MW): 20.1%
- PS (MW): 20.1%
- PP (MW): 20.1%
- others (MW): 20.1%

Commercial waste:
- Organics (CW): 64.3%
- Mixed paper (CW): 15.6%
- Cardboard (CW): 20.1%
- Multi-layer material (CW): 20.1%
- PET (CW): 20.1%
- HDPE (CW): 20.1%
- LDPE (CW): 20.1%
- PS (CW): 20.1%
- PP (CW): 20.1%
- others (CW): 20.1%

Urban waste:
- Organics (CW): 56%
- Mixed paper (CW): 17.4%
- Cardboard (CW): 26.6%
- Multi-layer material (CW): 26.6%
- PET (CW): 26.6%
- HDPE (CW): 26.6%
- LDPE (CW): 26.6%
- PS (CW): 26.6%
- PP (CW): 26.6%
- others (CW): 26.6%

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# 4. Results: Technical findings

## Leachate water analysis

### Concentration of leachate water

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>First pond</th>
<th>Last pond</th>
<th>River stream</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperatur on site</td>
<td>[°C]</td>
<td>24.6</td>
<td>24.7</td>
<td>24.8</td>
<td></td>
</tr>
<tr>
<td>COD by K₃Cr₂O₇</td>
<td>[mg/L]</td>
<td>602</td>
<td>455</td>
<td>211</td>
<td>&lt; 300</td>
</tr>
<tr>
<td>BOD₅ at 20°C</td>
<td>[mg/L]</td>
<td>241</td>
<td>137</td>
<td>63.4</td>
<td>&lt; 150</td>
</tr>
<tr>
<td>Total solid</td>
<td>[mg/L]</td>
<td>5,900</td>
<td>4,712</td>
<td>2,196</td>
<td></td>
</tr>
<tr>
<td>Ammonium</td>
<td>[mg/L]</td>
<td>8.11</td>
<td>8.14</td>
<td>7.77</td>
<td></td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>[mg/L]</td>
<td>7.25</td>
<td>7.97</td>
<td>10.79</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Total Phosphate</td>
<td>[mg/L]</td>
<td>1.84</td>
<td>2.01</td>
<td>1.41</td>
<td></td>
</tr>
<tr>
<td>Sulfate</td>
<td>[mg/L]</td>
<td>261</td>
<td>231</td>
<td>232</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>[mg/L]</td>
<td>1,104</td>
<td>985</td>
<td>485</td>
<td></td>
</tr>
<tr>
<td>Oil &amp; Grease</td>
<td>[mg/L]</td>
<td>6.67</td>
<td>&lt; 2</td>
<td>&lt; 2</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>[-]</td>
<td>7.74</td>
<td>8.33</td>
<td>8.09</td>
<td>6-9</td>
</tr>
<tr>
<td>Electrical conductivity</td>
<td>[umhos/cm]</td>
<td>12,590</td>
<td>8,810</td>
<td>4,350</td>
<td></td>
</tr>
<tr>
<td>Alkalinity</td>
<td>[mg/L]</td>
<td>201</td>
<td>50.26</td>
<td>20.11</td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>[mg/L]</td>
<td>0.19</td>
<td>0.15</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>[mg/L]</td>
<td>&lt; 0.002</td>
<td>&lt; 0.002</td>
<td>&lt; 0.002</td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>[mg/L]</td>
<td>&lt; 0.003</td>
<td>&lt; 0.003</td>
<td>&lt; 0.003</td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>[mg/L]</td>
<td>&lt; 0.0008</td>
<td>&lt; 0.0008</td>
<td>&lt; 0.0008</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>[mg/L]</td>
<td>&lt; 0.02</td>
<td>&lt; 0.02</td>
<td>&lt; 0.02</td>
<td></td>
</tr>
</tbody>
</table>

**Below threshold**

**Safe:** The concentration of leachate water

**Concern:** Gas emission

**Recommended:** Upgrading leachate water treatment facility
4. Results: Technical findings

Leachate water analysis
4. Results: Technical findings

Leachate water analysis
## Approaches to a technical optimization in waste management

1. **Overview**

2. **Questionnaire and sampling on site**

3. **Manual sorting and sample analysis**

4. **Results: Non-technical and technical findings**

5. **Technical concept**

6. **Non-technical concept**
5. Technical concept

1. Option A: Automated separation of wet & dry waste + technical composting

2. Option B: In case of separated sources – Processing of organic waste amounts for animal feed and fertilizer

3. Option C: Biological drying system and RDF production unit for organics and refuse material

4. Option D: Upgrading the leachate water treatment system and usage of the freed space for other purposes
## 5. Technical concept

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Option A:</strong> Automated separation of wet &amp; dry waste + technical composting</td>
<td></td>
</tr>
<tr>
<td><strong>2. Option B:</strong> In case of separated sources – Processing of organic waste amounts for animal feed</td>
<td></td>
</tr>
<tr>
<td><strong>3. Option C:</strong> Biological drying system and RDF production unit for organics and refuse material</td>
<td></td>
</tr>
<tr>
<td><strong>4. Option D:</strong> Upgrading the leachate water treatment system and usage of the freed space for other purposes</td>
<td></td>
</tr>
</tbody>
</table>
Option A: Automated separation of wet & dry waste + technical composting

Mixed waste → Size reduction → Screening → Rotting process → Compost

Organics
- Food waste
- Green waste
  - H₂O
  - CO₂

Recyclable materials

Automated bag opener
Screen
Trommel
5. Technical concept

Option A: Automated separation of wet & dry waste + technical composting

- **Mobile trommel – Double screen machines**
  - Price: 15,000-35,000 EUR

- **New trommel single screen machine**
  - Price: 205,000 EUR

- **Mobile trommel – Single screen machines**
  - Price: 45,000-130,000 EUR

New trommel single screen machine
## 5. Technical concept

**Option A: Automated separation of wet & dry waste + technical composting**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong></td>
<td>Mixed MSW from all sources</td>
</tr>
<tr>
<td><strong>Target:</strong></td>
<td>Separation of organic fractions, production of compost</td>
</tr>
<tr>
<td><strong>Income/Cost saving:</strong></td>
<td>Higher recycling rate, compost sales, less landfill volume needed</td>
</tr>
<tr>
<td><strong>Informal Sector:</strong></td>
<td>Can be included, or benefits from less organics</td>
</tr>
<tr>
<td><strong>Advantages:</strong></td>
<td>Cost-effective, enforcing recycling and lowers landfiling</td>
</tr>
<tr>
<td><strong>Challenges:</strong></td>
<td>Automated separation of organics from mixed streams with budget technology can be tricky</td>
</tr>
<tr>
<td><strong>Budget:</strong></td>
<td>Approx. 1.8 – 2.5 billion IDR (110 – 150 thousand EUR)</td>
</tr>
</tbody>
</table>
## 5. Technical concept

1. **Option A:** Automated separation of wet & dry waste + technical composting

2. **Option B:** In case of separated sources – Processing of organic waste amounts for animal feed

3. **Option C:** Biological drying system and RDF production unit for organics and refuse material

4. **Option D:** Upgrading the leachate water treatment system and usage of the freed space for other purposes
Option B: In case of separated sources – Processing of organic waste amounts for animal feed
5. Technical concept

Option B: In case of separated sources – Processing of organic waste amounts for animal feed and fertilizer
### 5. Technical concept

**Option B: In case of separated sources – Processing of organic waste amounts for animal feed and fertilizer**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong></td>
<td>Source-segregated biological fraction (kitchen + cuttings)</td>
</tr>
<tr>
<td><strong>Target:</strong></td>
<td>Production of valuable animal feed</td>
</tr>
<tr>
<td><strong>Income/Cost saving:</strong></td>
<td>Higher recycling rate, animal feed sales, less landfill volume needed</td>
</tr>
<tr>
<td><strong>Informal Sector:</strong></td>
<td>Can be included, or benefits from less organics</td>
</tr>
<tr>
<td><strong>Advantages:</strong></td>
<td>Brings business case, enforcing recycling and lowers landfilling</td>
</tr>
<tr>
<td><strong>Challenges:</strong></td>
<td>Operational know-how for the additives needed. External heat needed</td>
</tr>
<tr>
<td><strong>Budget:</strong></td>
<td>Approx. 13.9 – 36 billion IDR (850 – 2200 thousand EUR)</td>
</tr>
</tbody>
</table>
## 5. Technical concept

1. **Option A:** Automated separation of wet & dry waste + technical composting

2. **Option B:** In case of separated sources – Processing of organic waste amounts for animal feed

3. **Option C:** Biological drying system and RDF production unit for organics and refuse material

4. **Option D:** Upgrading the leachate water treatment system and usage of the freed space for other purposes
5. Technical concept

Option C: Biological drying system and RDF production unit for organics and refuse material

1. Closed system: SCT RDF drying system
2. Open system: Bio.Dry™ unit
3. External fire gas turbine (EFGT) mobile unit

Wet waste, unseparated → RDF drying → Dry waste → Incineration → Ashes

Air
5. Technical concept

Option C: Biological drying system and RDF production unit for organics and refuse material

1. Heap Set-Up
2. Building a Heap
3. Cover the Heap
4. Enclosed Heap
5. Material turning
6. Uncovering Heap
### 5. Technical concept

**Option C: Biological drying system and RDF production unit for organics and refuse material**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value: Budget level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong></td>
<td>Mixed MSW</td>
</tr>
<tr>
<td><strong>Target:</strong></td>
<td>Production of RDF materials</td>
</tr>
<tr>
<td><strong>Income/Cost saving:</strong></td>
<td>Contract with buyers (cement and power plants), less landfill volume needed</td>
</tr>
<tr>
<td><strong>Informal Sector:</strong></td>
<td>Can be included after drying, or benefits from less organics</td>
</tr>
<tr>
<td><strong>Advantages:</strong></td>
<td>Brings business case and lowers landfilling</td>
</tr>
<tr>
<td><strong>Challenges:</strong></td>
<td>Waste pickers could feel excluded</td>
</tr>
<tr>
<td><strong>Budget:</strong></td>
<td>Approx. 10.6 – 19.6 billion IDR (650 – 1200 thousand EUR)</td>
</tr>
</tbody>
</table>
Option C: Biological drying system and RDF production unit for organics and refuse material

1. Fuel Supply
2. Combustion system
3. Particle separator
4. Recuperator
5. Micro-gas Turbine
6. Exhaust gas purification
## Option C: Biological drying system and RDF production unit for organics and refuse material

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value: Budget level 12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong></td>
<td>Mixed MSW</td>
</tr>
<tr>
<td><strong>Target:</strong></td>
<td>Production of energy after recycling</td>
</tr>
<tr>
<td><strong>Income/Cost saving:</strong></td>
<td>Energy usage or sales, less landfill volume needed</td>
</tr>
<tr>
<td><strong>Informal Sector:</strong></td>
<td>Can be included after drying</td>
</tr>
<tr>
<td><strong>Advantages:</strong></td>
<td>Brings business case, renewable energies, lowers landfilling</td>
</tr>
<tr>
<td><strong>Challenges:</strong></td>
<td>Operational know-how needed</td>
</tr>
<tr>
<td><strong>Budget:</strong></td>
<td>Approx. 55.6 billion IDR (3100 thousand EUR) for a combined line (drying and WTE)</td>
</tr>
</tbody>
</table>
5. Technical concept

Option C: Biological drying system and RDF production unit for organics and refuse material
## 5. Technical concept

*Option C: Biological drying system and RDF production unit for organics and refuse material*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value: Budget level 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong></td>
<td>Mixed MSW</td>
</tr>
<tr>
<td><strong>Target:</strong></td>
<td>Production of energy after drying and recycling</td>
</tr>
<tr>
<td><strong>Income/Cost saving:</strong></td>
<td>Energy usage or sales – or sales of RDF, less landfill volume needed</td>
</tr>
<tr>
<td><strong>Informal Sector:</strong></td>
<td>Can be included after drying</td>
</tr>
<tr>
<td><strong>Advantages:</strong></td>
<td>Brings business case, renewable energies, lowers landfilling</td>
</tr>
<tr>
<td><strong>Challenges:</strong></td>
<td>Operational know-how needed</td>
</tr>
<tr>
<td><strong>Budget:</strong></td>
<td>Approx. 114 - 196 billion IDR (7,000 – 12,000 thousand EUR) for a combined line (drying and RDF)</td>
</tr>
</tbody>
</table>
## 5. Technical concept

1. **Option A:** Automated separation of wet & dry waste + technical composting

2. **Option B:** In case of separated sources – Processing of organic waste amounts for animal feed

3. **Option C:** Biological drying system and RDF production unit for organics and refuse material

4. **Option D:** Upgrading the leachate water treatment system and usage of the freed space for other purposes
Option D: Upgrading the leachate water treatment system and usage of the freed space for other purposes

1. LEACHATE WATER
   - WEHRLE
   - RO system
     - Highly polluted water
     - Clean water
     - Less polluted water
   - MBR system
2. WEHRLE

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12.08.2018
5. Technical concept

Option D: Upgrading the leachate water treatment system and usage of the freed space for other purposes

<table>
<thead>
<tr>
<th></th>
<th>CAPEX</th>
<th>OPEX</th>
<th>Effluent quality</th>
<th>Remains</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RO system</strong></td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>-</td>
</tr>
<tr>
<td><strong>MBR system</strong></td>
<td>-</td>
<td>+++</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Leachate water treatment scenario
5. Technical concept

Option D: Upgrading the leachate water treatment system and usage of the freed space for other purposes
5. Technical concept

Option D: Upgrading the leachate water treatment system and usage of the freed space for other purposes
Approaches to a technical optimization in waste management

1. Overview
2. Questionnaire and sampling on site
3. Manual sorting and sample analysis
4. Results: Non-technical and technical findings
5. Technical concept
6. Recommendations
6. Recommendations

1. Inclusion of the informal sector
2. In any case: Source segregation can save costs and efforts
3. Taking a deeper look into options A and B
4. Considering small WTE facilities in the region
5. Target: Reduction landfill amounts of 50%