A Climate Calculator for Solid Waste Management

‘SWM-GHG Calculator‘

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- GHG emissions and solid waste management
- Two methods to assess GHG emissions
  - IPCC approach
  - LCA approach
- Potential of GHG mitigation, target group Calculator
- SWM-GHG Calculator
GHG emissions from waste management

- Debits from direct emissions mainly $\text{CO}_2$, $\text{CH}_4$, $\text{N}_2\text{O}$
- Credits for substituting primary materials and/or energy

Waste Management contributes to climate protection

- Minimising or avoiding direct emissions, e.g. methane from landfilling
- Substituting primary materials production through material recycling
  = efficient resource use
- Substituting fossil energy sources through energy recovery

Two methods to assess GHG emissions:

- IPCC approach (Kyoto protocol: Common Reporting Format (CRF) in accordance with UNFCCC guideline and IPCC Good practice guidance)
- LCA approach (Life Cycle Assessment, ISO 14040/14044, cradle to grave)
IPCC approach (reporting commitment Kyoto Protocol)

- GHG source categories:

- Sector ‘Waste‘ = only GHG emissions from landfill, composting and incineration without energy recovery
  - Resulting in 2.8% contribution of solid waste management to GHG emissions
  - Contribution of GHG mitigation of recycling and energy recovery is reported in other sectors

→ GHG mitigation of waste management (sector waste) is underestimated
→ LCA approach to assess the total contribution of waste management to climate protection
LCA-approach (ISO 14040/14044, cradle to grave)

10-15% reduction possible

E.g. results from UBA study
GHG mitigation potential of selected countries:

Turkey  13%
Tunisia  16%
Mexico   10%
Potential of GHG mitigation – target group for the SWM-GHG Calculator

Developing countries and emerging economies:

- Mainly dumping = high potential for GHG mitigation (methane)
- Have few information to estimate GHG mitigation effects of alternative waste management activities
- Have few information about associated costs

→ SWM-GHG Calculator to provide orienting information on GHG mitigation effects of alternative waste management activities and associated costs

→ Sustainable waste management systems can significantly contribute to improve public health conditions and environmental protection
SWM-GHG Calculator

TOOL FOR CALCULATING GREENHOUSE GASES (GHG) IN SOLID WASTE MANAGEMENT (SWM)

Developed by

Sponsored and financed by
Goal:
- Simple manageability - excel, instructions given in the tool
- Low effort on data collection - default values
- Provision of background information - Manual

Features:
- Up to 4 scenarios can be compared at one time
- System approach (total waste amount and whereabouts): avoiding / minimising methane emissions, recycling, energy recovery
- Key aspect disposal routes
- Rough cost data / CO$_2$ mitigation costs

Required input data:
- Waste amount (total)
- Waste composition
- Emission factor electricity grid
- Share of recycling
- Kind of disposal of residual municipal solid waste

Band width / default values given as recommendation for all input data
Considered disposal routes

- Scattered waste with and without open burning
- Wild dumps / unmanaged disposal sites
- Controlled dump / landfill without gas collection
- Sanitary landfill with gas collection
  - parameters: - efficiency of gas collection
  - treatment of collected landfill gas
- Simple biological stabilisation and landfill
- MBT – RDF in cement kiln, MBT-residue to landfill
- MBS/MPS – RDF in cement kiln
- MSWI, parameters: - net efficiency of energy utilization

→ Parameters allow more accurate calculation of GHG emissions;
   Disposal via MBT/MBS/MPS is based on data for Germany
Recyclable fractions included

- Paper, cardboard
- Plastics
- Glass
- Ferrous metals
- Aluminium
- Textiles
- Food waste and garden, park waste
  - to composting
  - to anaerobic digestion

→ Calculation simplified with emission factors for recycling, representing the average situation in Germany, 2006
SWM-GHG Calculator

Information (sheet 'Calculations‘):
• Emission factors for energy demand
• Carbon content and calorific value
• Calculated waste characteristics for total waste and residual waste
• GHG emission factors for recycling (representing German situation)
• Calculation

Results:
• Waste amount and composition (in table form, graphically)
• Calculated GHG emissions per scenario
  (total and sectoral for recycling and disposal)
• Calculated total costs and specific costs per scenario
• Comparison of the calculated GHG emissions for the 4 scenarios
  (total and for recycling and disposal separately)
• Calculated total costs and mitigation costs compared to the Status Quo
Scenarios – treatment of total waste

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Status Quo</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scattered waste not burned</td>
<td>9.4%</td>
<td>9%</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Open burning of scattered waste</td>
<td>9.4%</td>
<td></td>
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</tr>
<tr>
<td>Wild dumps / unmanaged disposal site</td>
<td>75.0%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sanitary landfill with gas collection</td>
<td></td>
<td></td>
<td>80%</td>
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<tr>
<td>Simple biological stabilisation, landfill</td>
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<td>80%</td>
<td></td>
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<tr>
<td>MBS/MPS, RDF cement kiln</td>
<td></td>
<td></td>
<td></td>
<td>85%</td>
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<tr>
<td>Recycling</td>
<td>6%</td>
<td>11%</td>
<td>11%</td>
<td>15%</td>
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</tbody>
</table>
Note: No C-sink taken into account. Although the amount is quantifiable, it is not included in the greenhouse gas inventory under IPCC (1996, 2006). Furthermore, including the C-sink as standard for landfill sites is problematical in that this would only be correct if the C-sink were taken into account in all other possible areas, e.g. in furniture or books as well. Such comprehensive inclusion of the C-sink is not feasible, however.
Results comparison of scenarios – recycling, disposal separately

GHG emissions chart

<table>
<thead>
<tr>
<th></th>
<th>Debits</th>
<th>Credits</th>
<th>Debits</th>
<th>Credits</th>
<th>Debits</th>
<th>Credits</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonne CO₂-eq/yr</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Recycled waste</td>
<td></td>
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<td>Disposed of waste</td>
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<tr>
<td>Total MSW treatment</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Results Status Quo - sectoral

**GHG emissions - disposal**
- **Credits**
  - Incineration
  - MBS/MPS/co-proc
  - MBT/treatm/landfill
  - BS/landfill
  - Sanitary landfill
  - Controlled landfill
  - Wild dump
  - Burned-open
  - Scattered waste
- **Debits**
  - Incineration
  - MBS/MPS/co-proc
  - MBT/treatm/landfill
  - BS/landfill
  - Sanitary landfill
  - Controlled landfill
  - Wild dump
  - Burned-open
  - Scattered waste

**GHG emissions - recycling**
- **Credits**
  - Textiles
  - Aluminium
  - Ferrous Metals
  - Glass
  - Plastics
  - Paper, cardboard
  - Garden and Park waste
  - Food waste
- **Debits**
  - Textiles
  - Aluminium
  - Ferrous Metals
  - Glass
  - Plastics
  - Paper, cardboard
  - Garden and Park waste
  - Food waste
Limitations of the SWM-GHG Calculator

- No LCA according to ISO 14040 and 14044, because
  - only Global Warming Potential
  - Emission factors for recycling, MBT/MBS/MPS are only representative for the average situation in Germany, 2006
  - Using of recommended values (default values) is a strong simplification

- Waste prevention cannot be assessed
- Not applicable for calculating GHG mitigation in CDM projects

But: perspective

- Using emission factors for recycling is a possible approach to evaluate the effects of national action plans and programs (NAMA, PoA)
- Effort must be adequate = e.g. national data sets
- Sufficient representativeness must be given = emission factors can only be used if in compliance with specific conditions
Thank you

Download:

www.ifeu.de/SWM-GHG-Calculator

- SWM-GHG Calculator
- Example (protected)
- Manual

- Also Spanish version available

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