



# SWM-GHG Calculator (Calculador MRS-GEI)

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# Overview

- 1 General Tool Characteristics
- 2 Strength of Tool, important aspects included
- 3 Possible upgrades, important aspects not included

# SWM-GHG Calculator



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

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# Why a Tool for developing and emerging economies?

- MSW is often mainly dumped in developing and emerging economies = high potential for GHG mitigation (methane)
- Have few information to estimate GHG mitigation effects of alternative waste management activities
- ➔ SWM-GHG Calculator to provide orienting information on GHG mitigation effects of SWM
- ➔ Sustainable waste management systems can significantly contribute to improve public health conditions and environmental protection

Criteria	Characteristic
Target Group	Decision makers in developing and emerging countries
Intended use	Aid in understanding effects of proper waste management on GHG emissions
Methodology	LCA in waste management to allow system comparison (all resulting impacts related to total waste generated)
Features	<ul style="list-style-type: none"> <li>- Up to 4 scenarios can be compared at one time</li> <li>- System approach (generated waste and whereabouts)</li> <li>- Key aspect disposal routes</li> </ul>
Gases considered	CO2 fossil, CH4 regenerative and fossil, N2O
GWPI	IPCC 2007, GWP 100 (N2O=298, CH4reg=25)
Required input data	<ul style="list-style-type: none"> <li>- Waste amount (total) and waste composition</li> <li>- Emission factor electricity grid</li> <li>- Share of recycling</li> <li>- Kind of disposal of residual MSW</li> </ul>

# Required user competence, ease of use, accuracy

■ Excel based,  
Information in the Tool



- Common Software
- Quickest way to learn is to start the tool and follow given instructions
- Manual for background information

■ Open to public



- For download on website
- Modifications possible with permission of KfW

■ Orienting calculations,  
not too exact or too  
sophisticated



- Default values as recommendations
- Emission factors for recycling
- Fixed data for MBT, but parameters for MSWI and landfill to allow more accurate calculation

**Please fill in the green cells** ← Brief instructions

**Total waste amount**

The total waste amount refers to the total waste generated per year (that is not only waste collected by municipalities but overall quantity)  
 If you are not sure what you have to do at this step it is recommended to use the assistant (click button)

Assistant

Depending on the readily available data, the total waste amount can be either inserted into the green field in tonnes per year, or

Total waste amount	tonnes/yr		1.350.000
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... as an alternative, as specific waste quantity (in kg/cap/yr or kg/cap/day) combined with the number of inhabitants:

Specific generation rate of municipal solid waste

Instead of the total waste amount you can insert the specific waste quantity in kilogrammes per capita and year (kg/cap/yr) or in kilogrammes per capita and day (kg/cap/day) in the green fields  
 If no data are available the recommended default values a) for low income economies (LIE) or b) for middle income economies (MIE) may be selected to fill in the green fields  
 Additionally, specific values of IPCC 2006 for waste generation are given in the annex of the manual

Annual waste quantity per capita	Default LIE	Default MIE	kg/cap/yr
	175	275	
Daily waste quantity per capita	Default LIE	Default MIE	kg/cap/day
	0,48	0,75	

← Default values

Intermediate result / information

Your input results in a total waste amount of

<b>Result - total waste amount</b>	
tonnes/yr	1.350.000
kg/cap/yr	270
kg/cap/day	0,74

**Waste composition in percentages of wet weight**

Reference is the mass of wet waste of the total waste amount = waste to disposal and waste to recycling (this includes waste that is collected separately e.g. by informal sector)  
 If data on the total waste composition is available please enter the percentage - otherwise you can use:  
 - the given default values a) for low income economies (LIE) or b) for middle income economies (MIE) or  
 - default values from IPCC 2006 (see manual, annex)

<b>Components</b>			
Food waste			
Garden and park waste			
Paper, cardboard			
Plastics			
Glass			
Ferrous Metals			
Aluminium	0,2%	0,3%	0,3%
Textiles	1,4%	3,3%	3,3%
Rubber, leather	1,4%	1,9%	1,8%
Nappies (disposable diapers)	0%	4,0%	4,0%
Wood	3,5%	6,0%	6,0%
Mineral waste	6,0%	3,0%	3,0%
Others	13,8%	5,8%	5,8%
Total (must be 100%)	100,0%	100,0%	100,00%

If no information is available to distinguish between food waste and garden & park waste it is recommended to allocate the known percentage of organic waste to 50% to food waste and 50% to garden and park waste

← Information

**Waste characteristics**

Navigation: Title / Intro / **Start** / Recycling / Disposal / Costs / Results SQ / Results Sc1 / Results Sc2 / Results Sc3 / Results all / Results costs all / Calculation



# System comparison and waste activities

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	<b>Options for waste treatment and disposal</b>												
2	You can calculate up to 4 scenarios based on the given waste composition - if you want to change the waste composition you have to copy the excel file and start anew												
3	Please indicate here what happens to the residual municipal solid waste (= remaining waste amount after recycling)												
4	Explanation of the different treatment options see manual												
5													
6													
7		<b>Type of Waste treatment and disposal</b>											
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18	<b>Data on disposal technologies</b>												
19	Here you can specify the disposal technologies of landfilling and of incineration												
20	<b>Landfill</b>												
21	In case of sanitary landfill please insert here the overall portion of landfill gas that is collected as medium value over the lifetime of the sanitary landfill (further explanation see comment or manual)												
22													
23													
24													
25	Please define here the treatment of the overall collected landfill gas (further explanation treatment options see manual)												
26													
27													
28													
29													
30													
31													
32													
33	<b>Incineration plant</b>												
34	Please indicate here the net efficiency of energy utilization through waste incineration - use own data or default values (further explanations see comment or manual)												
35													
36													
37													
38													
39													
40													
41													

Status Quo Scenario 1 Scenario 2 Scenario 3

4 scenarios

Shall be avoided !!  
Simple treatment technologies  
Advanced technologies

Total waste considered  
BS: Biological stabilisation  
MBT: Mechanical-biological treatment  
MBS/MPS: Mechanical-biological stabilisation

Efficiency of gas collection  
Treatment of collected landfill gas  
Incineration plant

Parameters to allow more accurate calculation



# System comparison and waste activities

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	<b>Options for waste treatment and disposal</b>												
2	You can calculate up to 4 scenarios based on the given waste composition - if you want to change the waste composition you have to copy the excel file and start anew												
3	Please indicate here what happens to the residual municipal solid waste (= remaining waste amount after recycling)												
4	Explanation of the different treatment options see manual												
5													
6		<b>Type of Waste treatment and disposal</b>				<b>Status Quo</b>	<b>Scenario 1</b>	<b>Scenario 2</b>	<b>Scenario 3</b>				
7						in %	in %	in %	in %				
8	<b>Shall be avoided !!</b>	Scattered waste											
9		Open burning of solid waste											
10		Wild dumps/unmanaged landfills											
11	Simple treatment technologies	Controlled dump/landfills											
12		Sanitary landfill with BS + landfill											
13	Advanced technologies	MBT + further treatment											
14		MBS/MPS + co-processing											
15		Incineration											
16		Total (must be 100%)											
17													
18	<b>Data on disposal technologies</b>												
19	Here you can specify the disposal technologies												
20	<b>Landfill</b>												
21	In case of sanitary landfill please insert here the overall portion of landfill gas that is collected as medium value over the lifetime of the sanitary landfill (further explanation see comment or manual)												
22		Min	Max										
23		Efficiency of gas collection	10%	50%	0%	50%	0%	0%					
24													
25	Please define here the treatment of the overall collected landfill gas (further explanation treatment options see manual)												
26													
27	<b>Treatment of collected landfill gas</b>												
28		No treatment; ventilation only	0%	0%	0%	0%	in %						
29		Flare	0%	0%	0%	0%	in %						
30		Electricity generation											
31		Total (must be 100%)											
32													
33	<b>Incineration plant</b>												
34	Please indicate here the net efficiency of energy utilization through the incineration plant												
35		Default											
36		Electricity	15%	0,0%	0,0%	0,0%	0,0%	in %					
37		Thermal	0%	0,0%	0,0%	0,0%	0,0%	in %					
38													
39													
40													
41													

Parameters for gas collection efficiency very important, has high influence on results!

Energy generation from methane and from waste are included

# Important aspects realised in the Tool

- Considering waste generated allows overall assessment of optimisation measures
  - Key aspect disposal routes (landfill, open fires, incineration) are important sources for GHG-emissions and BC
  - Parameters for gas collection efficiency, gas treatment and efficiency of energy generation are very important due to high influence on results
  - Clear cut method and one harmonised set of emission factors for recycling allow comparability of results (benchmark)
  - System benefits are considered through credits
  - Landfill emissions not calculated as yearly emissions but all resulting impacts are related to waste amount landfilled
- ➔ NO monitoring, needs separate calculation

# Important aspects not realised in the Tool

- GHG-emission results only given as total CO<sub>2</sub>eq  
→ results should be given disaggregated for each pollutant
- Black Carbon not considered → could be added, but CO<sub>2</sub>eq better separately due to high uncertainties of GWPI
- Parameters for BC to allow changes due to high uncertainty range of emission factors and GWPI
- Monitoring not possible  
→ „report sheet“ could be added presenting input data and results which can be transferred to separate monitoring file  
→ Landfill FOD model could be added or linked for separate calculation (needs data for previous years, best back to 1950)
- GHG emissions from waste transportation  
→ usually of lower importance compared to disposal (landfill, combustion), but user should be enabled to assess the relevance

**Thank you!**

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