Better Waste Management Can Avoid GHG Emissions Significantly

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Federal Environment Agency  
GERMANY
Federal Environment Agency

Waste Technology
Waste Technology Transfer

Focus on the linkage of waste management and greenhouse gas emissions

GHG emissions from waste
**Share of GHG emissions from the waste sector**

According to the Intergovernmental Panel on Climate Change (IPCC) about 2.8% of all GHG emissions stem from the waste sector but only methane emissions from landfills are reported and waste incineration without energy recovery plus direct emissions from composting and MBT plants.

No avoided emissions from recycling (reported in Sector Industry) or energy recovery (reported in Sector Energy) are accounted for the waste sector.

- Several surveys commissioned by the Environment Agency to describe the "Climate Protection Potential in the Waste Management Sector"
- Surveys by other institutions: e.g. European Topic Center on Sustainable Production and Consumption (EEA); OECD
- Overall result: the mitigation potential is much higher than the IPCC figures make you think (between 12 and 16% of total GHG; up to 25% acc. IGES)
stages of the life cycle of products

Design, production and distribution phase

I. Primary Production
II. Production processes
III. Design of Products
IV. Logistic, distribution
V. Retail market

Use phase
VI. Decision: Shopping
VII. Use

Consumption and use

Waste Management
Recycling
Material recovery

Source: G. Dehoust; Öko-Institut 2012

Susann Krause,
German Federal Environment Agency
Methan-Emission from German Landfills
(IPCC - FOD - Method)
Changes in pathways for management of household waste

GHG emissions from waste
Scenarios

2006 current situation
GHG impacts and credits for recycling, incineration and treatment of residual waste on the basis of current technology  ➞ recycling rate about: 62 %

2020 Technology
improvement in the technical standards with unchanged waste flows. It is assumed that net efficiencies of plants and the gas yields of anaerobic digestion plants increase and higher value secondary products are produced  ➞ recycling rate about: 62 %

Scenario 2020 Abfall (waste)
change in the waste flows with increased collection and more recycling with unchanged technical standards. It is assumed that 50 % of the recyclable materials, still in the mixed residual waste in 2006, are additionally collected and utilised.  ➞ recycling rate about: 72 %

Scenario 2020 AT
the combination of the scenarios 2020 T and A.  ➞ recycling rate about: 72 %
GHG emissions from waste

Results for Germany

Mitigation 1990 to 2006
55.6 Mill. t CO₂-equivalents

Potential til 2020
65.3 Mill. Tonnen CO₂-equivalents

- Net emission
38 mill. t

- Total saving
65 mill. t

- Net credit
-27 mill. t
GHG emissions from waste

EUROSTAT MSW, 2007

[Bar chart showing the percentage of waste in landfilled, incinerated, composted, and recycled categories for various EU countries.]
Results EU27

- 2007 Burden from Landfilling up to 110 Mio t CO$_2$-eq

Potential 2020 up to 192 Mio t CO$_2$-eq through increased recycling and technical improvements in treatment plants
To exploit the Climate Protection Potential of an effective waste management in Europe we need

- a Europe wide landfill ban
  2007 GHG emissions by landfill in EU 27 caused up to **110 mill. tonnes** CO$_2$-equivalents

- increasing the recycling rate and value
  Potential 2020 recycling credits are up to **114 mill. tonnes** CO$_2$-equivalents

- waste-treatment with the best available technology to reduce GHG emissions
### GHG emissions from waste

#### Results and projections for EEA countries (Source: ETC /SCP)

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct - Recycling</th>
<th>Direct - Incineration</th>
<th>Direct - Landfilling</th>
<th>Direct - Transport</th>
<th>Avoided - Recycling</th>
<th>Avoided - Incineration</th>
<th>Avoided - Landfilling</th>
<th>Net GHG emissions</th>
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<tbody>
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### Diagram

- **Direct - Recycling**
- **Direct - Incineration**
- **Direct - Landfilling**
- **Direct - Transport**
- **Avoided - Recycling**
- **Avoided - Incineration**
- **Avoided - Landfilling**
- **Net GHG emissions**
Same emission factors in A, B, C (=same avoided processes)

Waste volume A = B
-> system comparison possible
B in favor of A due to change in share of disposal options

Waste volume C > A, B
-> no system comparison possible,

Can be used to describe development of total emissions

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Waste Volume (t)</th>
<th>CO2eq (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2000</td>
<td>295</td>
</tr>
<tr>
<td>B</td>
<td>2000</td>
<td>-286</td>
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<tr>
<td>C</td>
<td>3000</td>
<td>-429</td>
</tr>
</tbody>
</table>

- 50% landfill
- 35% incineration
- 15% recycling

- 10% landfill
- 50% incineration
- 40% recycling
Development of GHG emissions from landfills

Source: Monni et al.
Thank you for your attention!

marlene.sieck@uba.de

Further information: www.umweltbundesamt.de
GHG emissions from waste

Technology Transfer

Informationssammlung über Ansätze zur nachhaltigen Gestaltung der kommunalen Abfallbewirtschaftung und dafür geeignete deutsche Technologien und Ausrüstungen

Information pool on approaches towards a sustainable design of municipal waste management and supporting German technologies and equipment

Observatoire des solutions durables pour la maîtrise des déchets des communes, des technologies et des équipements allemands

Информационный сборник по подходам к устойчивой организации муниципального менеджмента отходов и подходящим немецким технологиям и оборудованию

Bewährte Verfahren zur kommunalen Abfallbewirtschaftung

Best Practice Municipal Waste Management

Meilleures pratiques en maîtrise des déchets des communes

Испытанные методы муниципального менеджмента отходов

Gefördert durch Umwelt Bundesamt
Erstellt durch intecus
Methodology

• GHG-balances following **Life Cycle Assessment** approach LCA standard ISO 14040

• **No waste reduction or increase** was assumed for the scenarios to show only the effects of the waste handling

• Calculations for each separated collected **waste type** and for **residual waste** to
  - incineration (MSWI plants) and
  - mechanical-biological treatment/stabilisation

• Assumption for potential scenarios: using existing technology of the current situation in Germany and Europe
### GHG emissions from waste

Possible substitute processes, taking waste incineration plants as an example

<table>
<thead>
<tr>
<th>Waste incineration plant without energy utilisation</th>
<th>Waste incineration plant plus power</th>
<th>Waste incineration plant plus power and heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debit (plus): CO₂ emissions from waste incineration plant due to combustion of fossil components in waste</td>
<td>Debit (plus): CO₂ emissions from waste incineration plant due to combustion of fossil components in waste</td>
<td>Debit (plus): CO₂ emissions from waste incineration plant due to combustion of fossil components in waste</td>
</tr>
<tr>
<td>Credit (minus): CO₂ emission savings due to avoidance of power generation in power plants</td>
<td>Credit (minus): CO₂ emission savings due to avoidance of power generation in power plants</td>
<td>CO₂ emission savings due to avoidance of heat generation by a typical household heating system</td>
</tr>
</tbody>
</table>
GHG emissions from waste

![Graph showing Greenhouse effect due to municipal waste](image-url)

<table>
<thead>
<tr>
<th>Year</th>
<th>Basis I</th>
<th>Basis II</th>
<th>Optimised</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>37.8</td>
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<td></td>
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<tr>
<td>2005</td>
<td>-7.7</td>
<td></td>
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<tr>
<td>2020</td>
<td>-10.7</td>
<td>-11.5</td>
<td>-13.2</td>
</tr>
</tbody>
</table>

Credits (CR)
- CR Waste incineration
- CR Co-incineration
- CR Biowaste
- CR Lightweight packaging
- CR Waste paper
- CR Waste glass
- CR Bulky waste/waste wood
- CR Metals
GHG Reduction Goals:

➤ Kyoto Protocol:
  • total cut of at least 5% by 2012 (baseline of 1990)
  • European Union: 8 %
  • Burdon Sharing; differentiated reduction goals
  • Germany: reduction goal by 21%

➤ Post-Kyoto-Process:
  further development by 2020

➤ European Union: 20 (30) % by 2020

➤ Germany: 30 (40) % by 2020
The Climate Protection Potential of waste management in Europe

- Changing the net emissions 78 mill. tonnes CO$_2$-equivalents in 2007 into a credit of up to 114 mio. tonnes CO$_2$-equivalents until 2020

the total net saving is

192 mio. tonnes CO$_2$-equivalents

This corresponds to 32% of the 600 mio. tonnes CO$_2$-equivalents that the EU27 still has to minimize according to the voluntary target for 2020!
Landfill-methane as a major climate problem

Methane has a 25 times higher Global Warming potential than CO₂

Methane accounts for 16% of global greenhouse gas emissions from human activities

Landfills are the single largest anthropogenic source of methane (US EPA)

Landfills are a significant emitter of greenhouse gas emissions and a serious climate change problem (!)
Methane emissions from landfill sites in Germany in Gg (IPPC-FOD)
GHG emissions from waste