Bio-Waste and Climate Change

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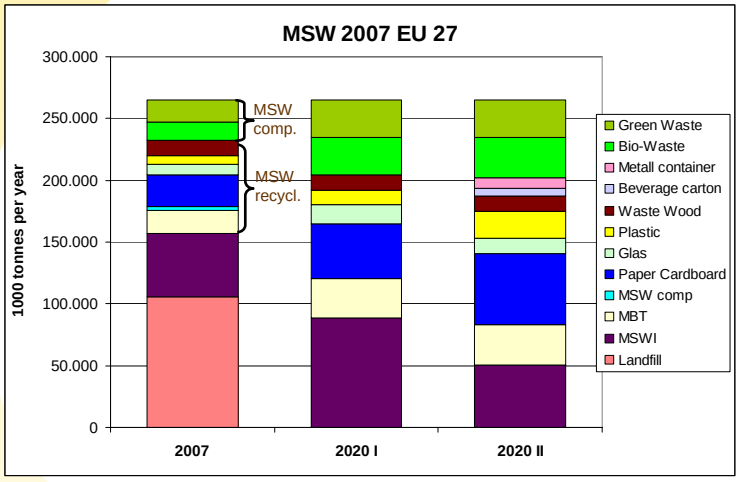
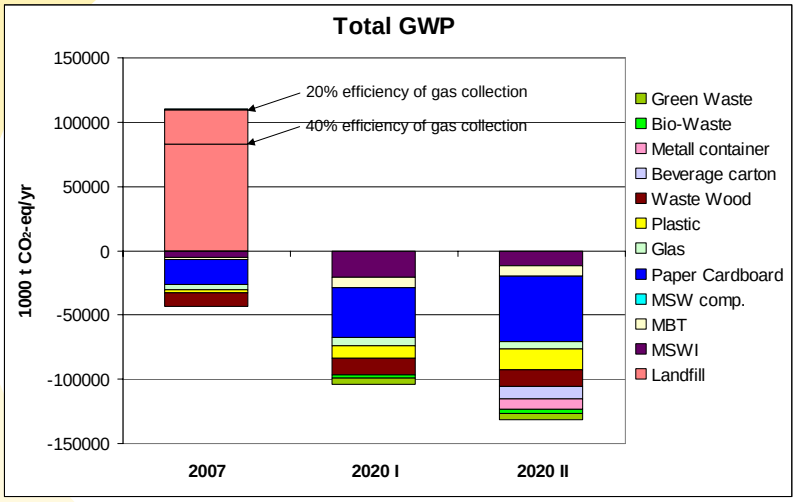
- MSW and biowaste treatment in the EU 27
- GWP balance MSW treatment in the EU 27
- Potential of bio- and green waste in Germany
- Current treatment of bio- and green waste in Germany
- GWP balance current situation
- GWP balance optimisation scenario

Current situation and potential of MSW treatment EU 27



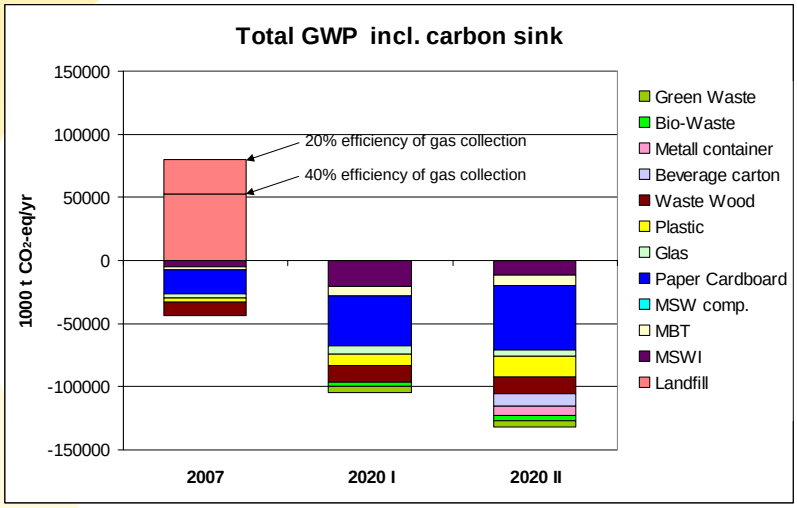
Source: current project IFEU Heidelberg, Öko-Institut Darmstadt: „Potential for climate protection through waste management“
waste quantities data based on Eurostat, ORBIT/ECN 2008, Prognos 2008

GWP balance current MSW treatment and potential EU 27 preliminary results



Source: current project IFEU Heidelberg, Öko-Institut Darmstadt: „Potential for climate protection through waste management“

GWP balance current MSW treatment and potential EU 27 preliminary results incl. carbon sink



Source: current project IFEU Heidelberg, Öko-Institut Darmstadt: „Potential for climate protection through waste management“

Amounts and potential of bio- and green waste

	Bio- and green waste	
Germany	tonnes/yr	kg/cap/yr
Source separated collection 2006 (50% bio-waste, 50% green waste)	**7,800,000**	**95**
Bio- and green waste in MSW (grey bin)	4,500,000	55
Biowaste potential for further easily realizable source separated collection	1,500,000	18
Estimated green waste potential for further source separated collection	760,000	9
Possible total source separated collection for Germany	**10,060,000**	**122**
EU 27		
MSW composted (Eurostat 2007)	42,000,000	85
Estimated share of source separated collection of bio- and green waste	32,400,000	65

Source: German Federal Statistical Office, Eurostat, ORBIT/ECN 2008

Treatment – current situation and potential in Germany

Bio- and green waste are mainly composted in Germany, only biowaste (biowaste bin) is digested (31%)

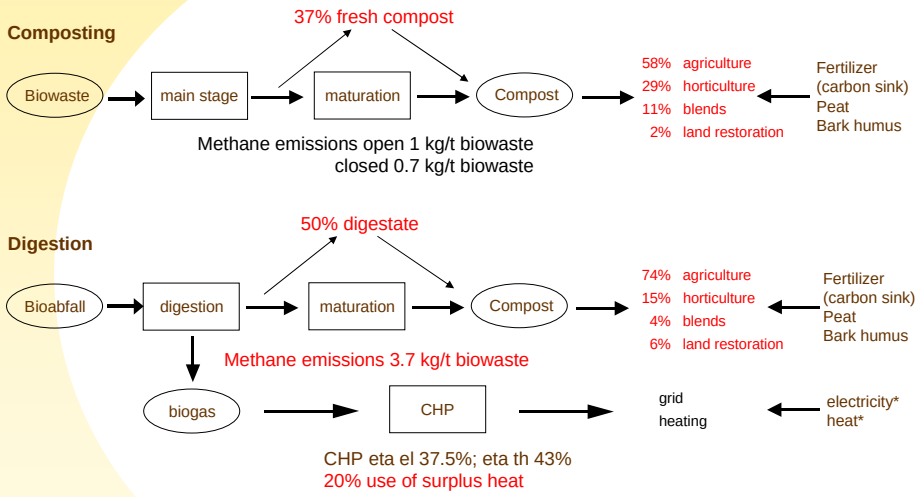
In general, biowaste from the biowaste bin is qualified for digestion, green waste only to a certain extent

With digestion energy is produced in addition to compost. The composted digestate has a lower organic content due to biogas production. It also has a lower nutrient content but this can be an advantage as this is a criteria for blends

In Germany about 200 of the existing composting plants could be retrofitted with a digestion step ahead of the composting (mainly plants with advanced technical configuration and a minimum yearly capacity of 10,000 tonnes)

Green waste could be mechanically separated into fractions qualified for energy recycling (wood-CHP), energy and material recycling (digestion) and a composting fraction

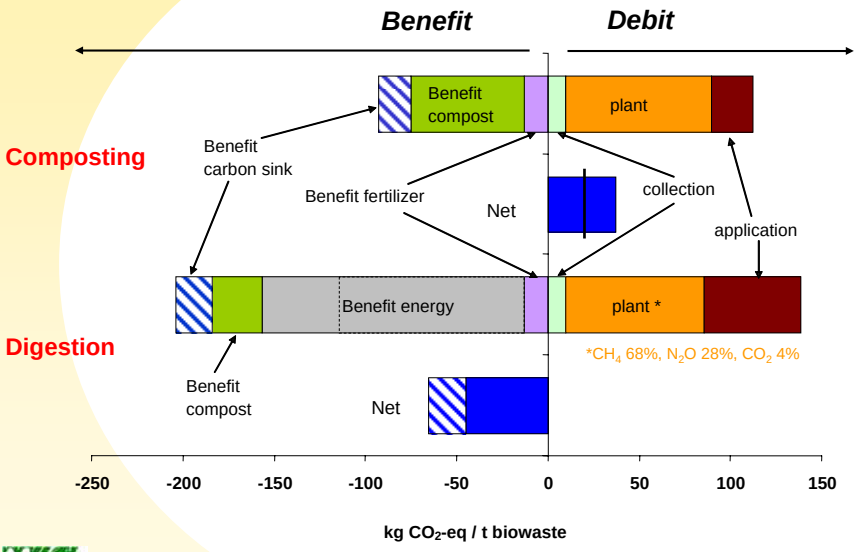
Current situation composting / digestion of biowaste



*consequential approach for substituted energy: electricity: 59% hard coal, 16% lignite, 25% natural gas
heat: 50% oil heating, 50% natural gas heating

Note: biogenic methane emissions from landfill are 31 kg/t waste with 40% efficiency of gas collection and 41 kg/t waste with 20% efficiency of gas collection

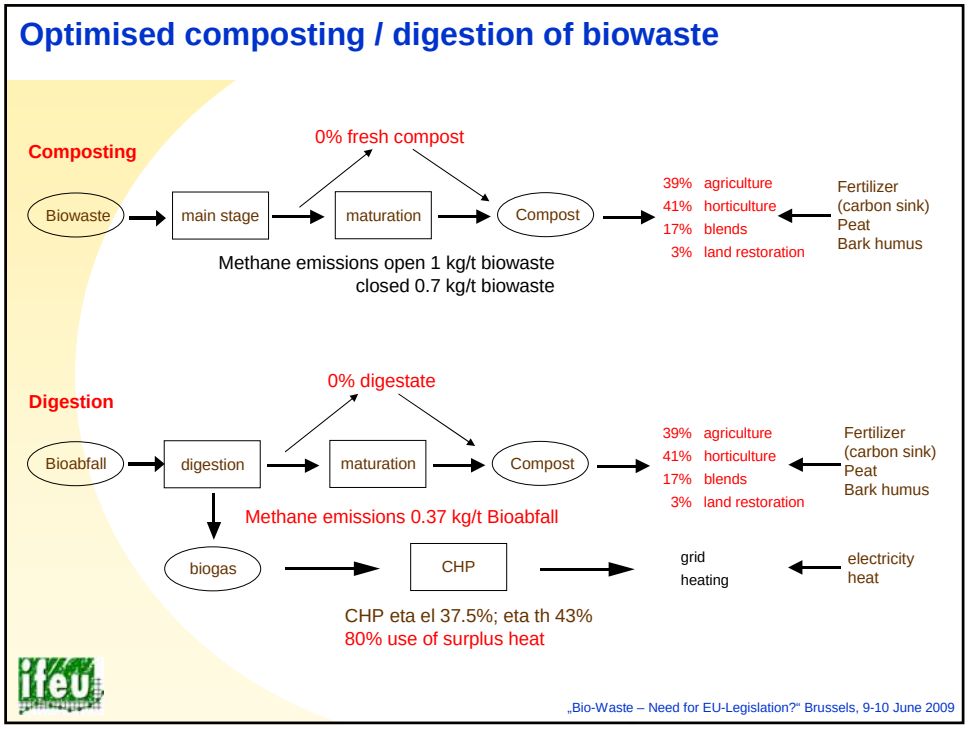
GWP balance composting / digestion current situation

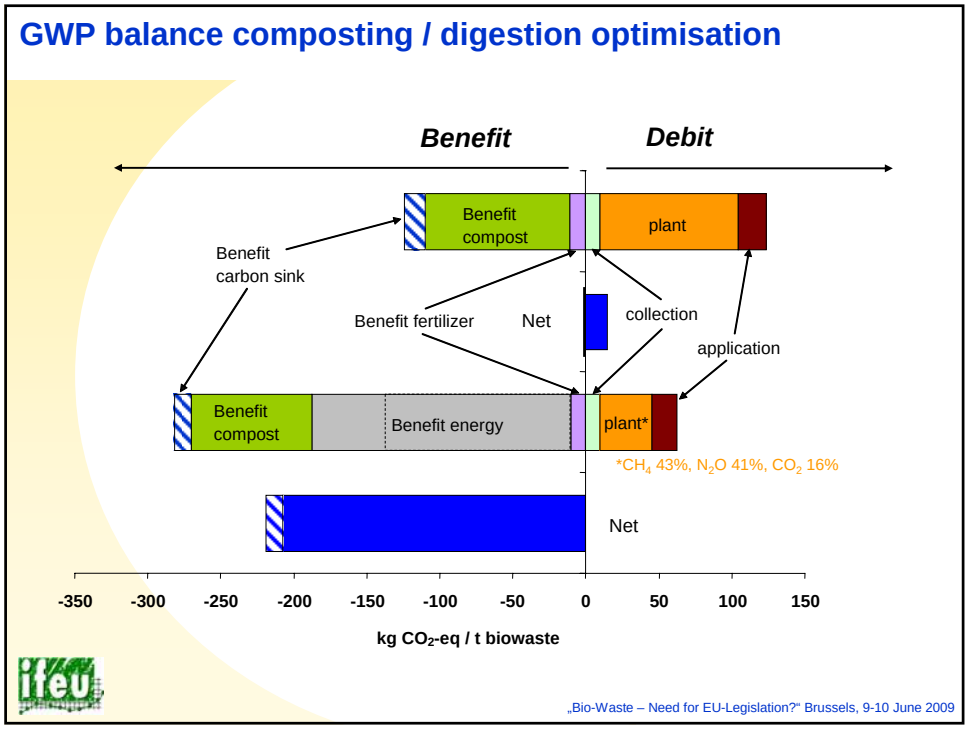


Current situation composting / digestion of biowaste

- Currently composting of biowaste in Germany results in a slight increase of green house gases; this is also valid if the carbon sink* is taken into account
- Currently digestion in Germany is combined with higher methane emissions (digestion and application of fresh digestate) than composting. Nevertheless, benefits from the produced energy surpass the direct emissions
- The carbon sink is higher with digestation than with composting because more digestate is applied in agriculture
- The benefit from energy production is mainly due to electricity production (electricity approx. 132 kg CO_2-eq/t biowaste, heat 11 kg CO_2-eq/t biowaste)
- The benefit from electricity production would be reduced to 102 kg CO_2-eq/t biowaste if electricity mix from grid would be substituted instead of the consequential fossil energy mix

*Source carbon sink: AEA Technology Environment: Waste Management Options and Climate Change. Final Report to the EC, DG Env. July 2001 (page 140: approx. 8% of carbon remain in soil after 100 years)


Optimised composting / digestion of biowaste
Composting
0% fresh compost
Biowaste
main stage
maturation
Compost
39% agriculture
41% horticulture
17% blends
3% land restoration
Fertilizer (carbon sink)
Peat
Bark humus
Methane emissions open 1 kg/t biowaste
closed 0.7 kg/t biowaste
Digestion
0% digestate
Bioabfall
digestion
maturation
Compost
39% agriculture
41% horticulture
17% blends
3% land restoration
Fertilizer (carbon sink)
Peat
Bark humus
Methane emissions 0.37 kg/t Bioabfall
biogas
CHP
grid heating
electricity heat
CHP eta el 37.5%; eta th 43%
80% use of surplus heat
„Bio-Waste – Need for EU-Legislation?" Brussels, 9-10 June 2009


GWP balance composting / digestion optimisation
Benefit
Debit
Benefit compost
plant
Benefit carbon sink
Benefit fertilizer
Net
collection
application
Benefit compost
Benefit energy
plant*
*CH4 43%, N2O 41%, CO2 16%
Net
-350
-300
-250
-200
-150
-100
-50
0
50
100
150
kg CO2-eq / t biowaste
„Bio-Waste – Need for EU-Legislation?" Brussels, 9-10 June 2009

Optimised composting / digestion of biowaste

- Optimising composting of biowaste by producing mature compost with a higher potential to substitute peat still results in a slight increase of green house gases but the net debit is over 60% lower than in the current situation; if the carbon sink* is taken into account the net debit is reduced to zero
- Using compost as peat substitute results in higher benefits than using compost in agriculture (carbon sink)
- For digestion a high optimisation potential exists when methane emissions are reduced to 10% of the current situation (e.g. via waste air treatement; debits are reduced from 139 to 63 kg CO_2-eq/t biowaste)
- The benefit from energy production from digestion is increased if 80% of the surplus heat can be used instead of only 20% (from 11 to 46 kg CO_2-Äq/t biowaste)

Conclusions

- **Currently, waste treatment in the EU 27 causes at least 50 million tonnes CO_2-eq through landfilling of biodegradable waste per year In case of less efficiency of gas collection and disregarding the carbon sink, the yearly emissions are 110 million tonnes CO_2-eq**
- **Due to the landfill ban in Germany no more methane emissions result from depositing of biodegradable waste, and waste management in Germany is now contributing to climate protection instead of causing climate change**
- **In Germany further 2.3 million tonnes of bio- and green waste could easily be collected source separately**
- **Composting could be optimised by producing mature compost which can be used in horticulture or in blends to substitute peat**
- **There exists a high optimisation potential for digestion by reducing methane emissions (e.g. via waste air treatment)**
- **The combined energy and material recycling shows higher advantages according to climate change than composting only**