



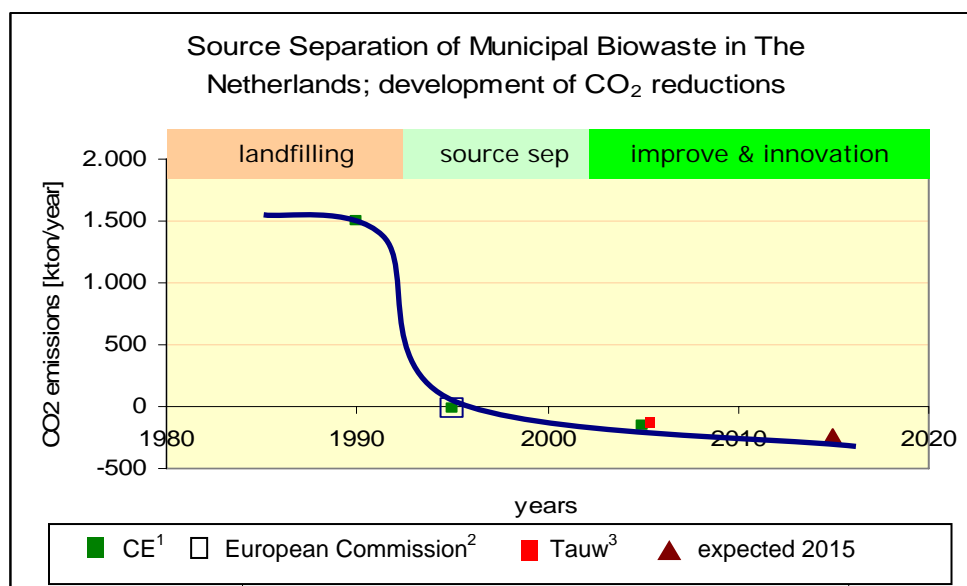
Contribution of cost effective anaerobic digestion to sustainable biowaste management and climate protection in The Netherlands

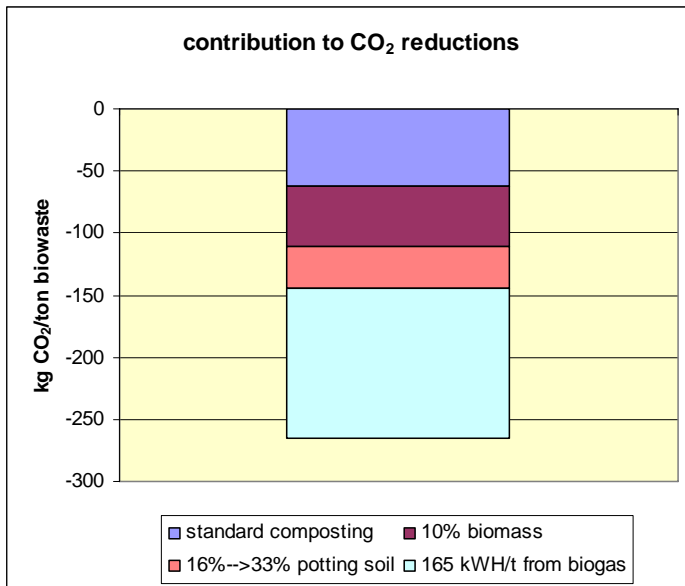
In 1990 (Kyoto base year) Municipal Biowaste was not separated at source in The Netherlands. A lot of waste was land filled and existing Waste Incinerators had to comply with severe emission standards (dioxins). Especially land filling of the Biowaste Component of Municipal waste contributed to emissions of the greenhouse gas methane. 1,5 million tons of land filled municipal waste generated ± 1.000 kg CO_{2-eq}/ton, 1.500 kton CO_{2-eq}/year.¹

In 1994 source separation of Municipal Biowaste was implemented by law (completed in 1995) resulting in 1.5 million tons of Biowaste to be composted each year and diverted from the landfill. As a result, the mentioned emissions of 1.500 kton CO_{2-eq} were avoided. Farmers using compost save on the use of artificial fertilizer in agriculture and contribute to soil carbon sequestration. This results in net savings (negative flux of -11,3 kg CO_{2-eq}/ton Biowaste, -17 kton CO_{2-eq}/year based on 1.500 kton Biowaste/year)^{1,2}

In 2007 composting processes were strongly improved, energy consumption was lowered, resulting in high quality compost. More compost was sold replacing peat in potting soils and gardening. A quick scan at four composting plants demonstrated lower process emissions. These results were confirmed by TAUW³ in 2007. The negative flux for greenhouse gases improved to -90 kg CO_{2-eq}/ton Biowaste, -135 kton CO_{2-eq}/year based on 1.500 kton Biowaste/year^{1,3}

In 2015 we expect this development to continue. Composters increase their environmental performance, selling more high quality compost for peat replacement, produce upgraded biomass, ready to use for biomass power plants. The share of Anaerobic digestion is increasing. Importance of compost suppressing plant diseases is growing. Results of public RFP (province Utrecht, 2007) granted on price and CO₂ performance indicate results in savings on greenhouse gases up to 160 kton CO_{2-eq}/ton of Biowaste to be realized in 2009. So this is achievable as mean value in 2015 for the Dutch amount of 1.500 kton Biowaste, resulting in -240 kton CO_{2-eq}/year.





The figure demonstrates the contribution of different process improvements to the reduction of CO₂. Composting upgraded by biomass production and 33% compost replacing peat in potting soils, adds up to -144 kg CO₂/ton biowaste. When anaerobic digestion is implemented before composting, moderate biogas production for power will achieve an additional -120 kg, total -264 kg CO₂/ton biowaste. Further improvements can be made maximizing biogas yields and using CHP.

In the Netherlands, since 1997 one anaerobic digestion plant is operational for source separated municipal biowaste, the Biocel in Lelystad. There is a portfolio of 10 projects for anaerobic digestion. Investment decisions depend largely on the new SDE (arrangement for sustainable energy). It is calculated that about € 140/MWh, including funding by SDE, is needed to support the change to an (even more) sustainable processing of municipal biowaste in The Netherlands

year	2008	2009	2010	2011	2012	2013	MWhel/y
Portfolio 657 kton/y							114.756
Additional 900 kton/y							157.200
Total 1.557 kton/y							271.956

References

Kton CO_{2-eq} emissions related to 1.500 kton (source separated) municipal biowaste

year	CE ¹	EC ²	Tauw ³	Expected Level 2015	page of report and mentioned numbers
1990	1.500				CE p 26: 975-1.046 kg CO _{2-eq} /t Municipal Waste
1994	-19	-15			EC p 37: -10 kg CO _{2-eq} /t (closed composting); CE p 36 (assumed high emissions of the process)
2007	-135		-135		CE p 36: -90,7 kg CO _{2-eq} /t (composting with improved control of emissions, most probable level) The Tauw-study, covering all 5 applied Dutch composting and digestion systems for municipal biowaste, confirmed low CH ₄ and N ₂ O emission levels
2015				-240	Results of request for proposal Utrecht is reported to the related municipalities in this province and indicated this will be the achievable level for the years to come.

¹ CE 2006 (published in Dutch language)Waste treatment and CO₂ Quick scan of greenhouse gas emissions of the waste sector in The Netherlands (covering land filling, incineration and composting)

² European Commission 2001 Waste management options and climate change

³ Tauw 2007 (published in Dutch language) Study representative values for CH₄ and N₂O emission levels in Dutch municipal biowaste composting and digestion.