Home and community composting

In a nutshell

Summary overview							
In cases when home and community composting is the most appropriate waste management option for biowaste based on the waste management strategy adopted and/or on an LCA study on waste management options (see best practices Integrated waste management strategies and Life Cycle assessment of waste strategies), it is best practice to: • Systematically deploy and promote home and community composting, keeping track of the number of residents involved, registering where composting equipment is installed and operated. • Organise initial awareness-raising campaigns through graphic material, public meetings, waste advisers, etc. (see the best practice Establishment of a network of waste advisers) informing and training residents about home and community composting, its benefits, its correct operation (in order to limit methane emissions and pollution to soil, and ensure that the output is good quality compost), which biowaste is suitable, etc. • Regularly update and train residents on the correct operation of home and community composting. • Regularly monitor home and community composting sites. A number of representative sites can be inspected every year to check the correct operation of composting and ensure its environmental benefits.							
Waste management area							
Cross-cutting	**MSW - strategy**	**MSW - prevention**	**MSW - collection**	**MSW - EPR**	**MSW - treatment**	**CDW**	**HCW**
Applicability							
In cases when home and community composting is the most appropriate waste management option for biowaste, there are no major restrictions to implementing this best practice. However, the success of home and community composting as an environmental management strategy is highly dependent on the management of the waste separation and composting process by citizens who must be first engaged to motivate them to separate organic waste, and then trained to correctly manage the composting process. Additional effort is required to organise home and community composting in urban areas.							
Specific environmental performance indicators							

In addition to the common environmental performance indicators presented in the best practice Common environmental performance indicators, the most appropriate indicators to assess the successful implementation of this best practice are:

share of population doing home composting or to which community composting is available (% of total population in the waste management catchment area);

share of population implementing home/community composting correctly, on the basis of an annual visit and analysis of the compost produced (% of the population doing home composting or to which community composting is available);

system in place for regular follow-up with residents doing home composting (y/n);

Share of home composters visited annually (% of the households doing home composting).

Benchmark of excellence

All residents have access to either separate collection of biowaste or home and community composting of biowaste.

Description

Home and community composting refers to the composting (i.e. the managed aerobic decomposition) of domestic organic waste from kitchens and gardens by householders or in small community composting facilities. Home and community composting avoids the economic costs and environmental burdens associated with organic waste collection. Home and community composting can be adopted when other biowaste management options (anaerobic digestion and centralised composting) are less appropriate based on the waste management strategy adopted and/or an LCA study on waste management options (see also best practices Integrated waste management strategies and Life Cycle assessment of waste strategies).

A major advantage of home and community composting in regions with low organic waste recycling rates is that it can generate “buy-in” from citizens who are otherwise less likely to separate organic waste, thus significantly decreasing residual waste volumes and increasing overall recycling rates (SYBERT, personal communication 2015). Such an effect could be particularly important among lower socio-economic classes in inner city areas (WYG Environment, 2011). Another important benefit of home and community composting is the replacement of peat used in hobby gardening (Andersen et al., 2012).

When implementing home and community composting (Figure 1), it is best practice to:

- Systematically deploy and promote home and community composting, keeping track of the number of residents involved, registering where composting equipment is installed and operated.
- Organise initial awareness-raising campaigns through graphic material, public meetings, waste advisers, etc. (see the best practice Establishment of a network of waste advisers) informing and training residents about home and community composting, its benefits, its correct operation (in order to limit methane emissions and pollution to soil, and ensure that the output is good quality compost), which biowaste is suitable, etc.
- Regularly update and train residents on the correct operation of home and community composting.
- Regularly monitor home and community composting sites. A number of representative sites can be inspected every year to check the correct operation of composting and ensure its environmental benefits.

Source: E3 Environmental Consultants Ltd

Figure 1. Example of a community composting point in Besançon, France

Environmental benefits

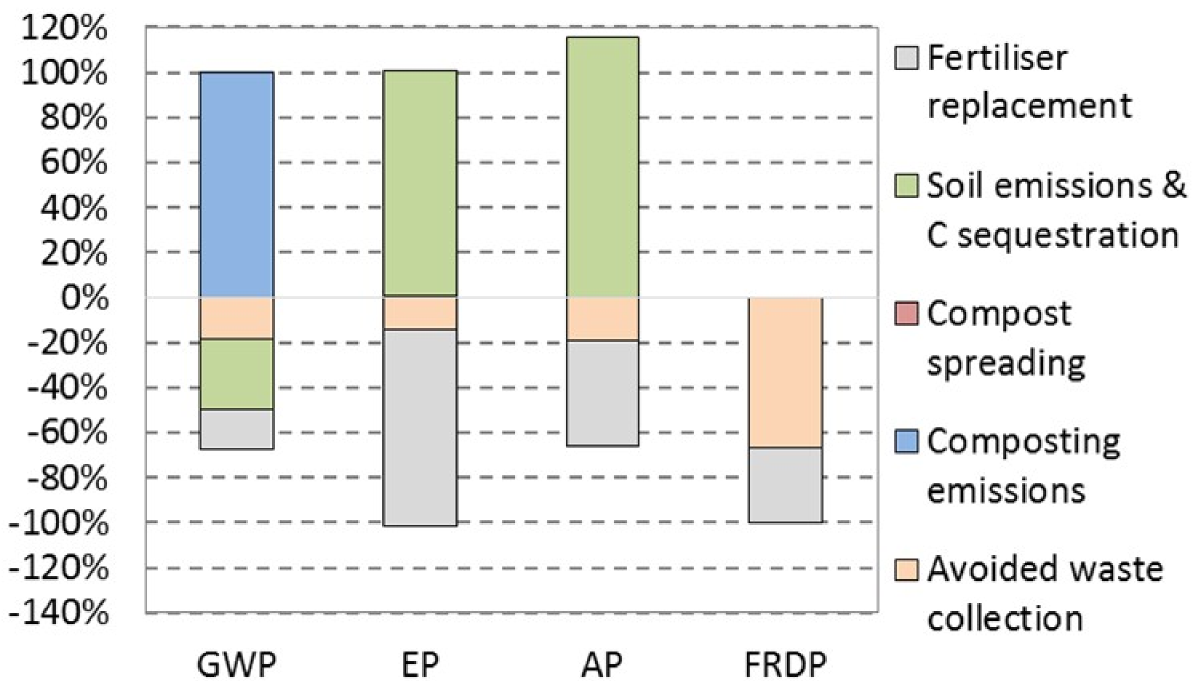
Life-cycle assessment of composting

Table 1 and Figure 2 summarise life-cycle environmental burdens and credits for home composting of organic household waste (OHW), comprising food waste and green waste, based on data from various sources. Some aspects are uncertain and highly dependent on specific management practices. Although EC (2010) reported significant methane and ammonia emissions for in-vessel composting, Andersen et al. (2012) report negligible ammonia emissions and variable methane emissions of between 0.4 kg and 4.2 kg per tonne of wet OHW. These emissions are highly dependent on process management and can be minimised under best practice. The proportion of organic N added to soils in compost that replaces fertiliser manufacture and application is highly dependent on the type of land to which the compost is applied, the precision of any nutrient management planning applied to calculate fertiliser application rates, and the period of time considered. In the short term (two years), only 11 % of organic N is likely to be available to plants and could potentially replace fertiliser-N (Nicholson et al., 2013). But, over the longer term, organic N mineralisation could result in considerably greater fertiliser-N replacement. For the LCA calculation here, it was assumed that 20 % of organic N could replace fertiliser-N in the long term (Andersen et al., 2012). Unlike centralised composting, home composting does not require diesel or electricity input (unless an automatic composter is used).

Table 1. Environmental burdens and credits calculated for home composting using life-cycle assessment

Environmental burdens	Environmental credits

• Methane emissions during composting of 2.3 kg CH_4-C per tonne of wet waste, median of 0.4 kg to 4.2 kg CH_4-C reported in Andersen et al. (2012). • Nitrous oxide emissions of 0.075 kg N_2O per tonne of wet waste (Saer et al., 2013), which corresponds closely with an N_2O-N emission factor of 0.6 % total N cited in IPCC (2006). • Ammonia volatilisation during spreading equivalent to 3.6 % of compost N (Nicholson et al., 2013). • Soil N_2O emissions of 1 % of applied N (Tier 1, IPCC, 2006). • Nitrate leaching based on Nicholson et al. (2013) for food/green compost.	• Avoided fertiliser manufacture and application emissions based on long-term fertiliser replacement values of 20 % for applied N (Andersen et al., 2012), and 50 % and 80 % for applied P and K, respectively (Nicholson et al., 2013). • A long-term (100-year) soil organic carbon sequestration credit equivalent to 14 % of C in the compost (Bruun et al., 2006; Møller et al., 2009). • Avoided food waste collection (7.2 litres of diesel per tonne).



N.B. This represents the best case where available nutrients in the compost replace fertiliser application.

Figure 2. Environmental credits (negative values) and burdens (positive values) for home composting of organic household waste across four environmental impact categories (global warming potential (GWP), eutrophication potential (EP), acidification potential (AP), fossil resource depletion potential (FRDP)).

Based on Table 1, the following net burdens were calculated for composting one tonne of OHW (wet weight basis):

- global warming potential: 32 kg CO_2e;
- eutrophication potential: 0.0 kg PO_4e;
- acidification potential: 0.18 kg SO_2e;

- fossil resource depletion potential: -359 MJe.

Thus, home composting leads to relatively minor net burdens across three of the four impact categories considered, and a significant fossil resource depletion of -359 MJ equivalent per wet tonne of OHW composted if the avoidance of waste collection is considered. However, there is considerable uncertainty over CH_4 and N_2O emission factors. If the highest CH_4-C and N_2O-N emission factors reported in Andersen et al. (2012) are applied, then the GWP of home composting increases over tenfold to 331 kg CO_2e per wet tonne of OHW.

However, Andersen et al. (2012) reported a modest additional GWP credit for OHW compost on the assumption that approximately 20 % of the home compost produced in Denmark replaces peat used in hobby gardening.

Comparison with alternative waste treatment options

Andersen et al. (2012) found that home composting performed comparatively well against landfilling and incineration in terms of nutrient enrichment, acidification and ecotoxicity in water, but less well in terms of GWP owing to energy recovery from the other two options in the Danish context. However, under a scenario of some landfill methane leakage, perhaps more typical of European landfills overall, composting performed considerably better than landfilling in terms of GWP.

Biogas electricity generation can avoid 1 227 MJe of fossil energy per tonne of food waste. Anaerobic digestion thus performs considerably better than composting in terms of global warming potential and fossil resource depletion, but less well in terms of eutrophication and acidification owing to ammonia emissions from digestate. Styles et al. (2015) calculated the following life-cycle net environmental burdens for anaerobic digestion of one wet tonne of food waste:

- global warming potential: -95 kg CO_2e;
- eutrophication potential: 0.5 kg PO_4e;
- acidification equivalent: 0.59 kg SO_2e;
- fossil resource depletion potential: -1,340 MJe.

Soil quality improvement

Compost returns almost three times more carbon to the soil than digestate, per tonne of food waste treated, leading to greater soil quality improvement, which will lead to indirect environmental benefits in terms of soil biodiversity and functioning, including crop yields, not accounted for in the above LCA.

The greatest degree of soil improvement and associated environmental benefits arise when compost is applied to soils with a low organic matter content, especially heavily cultivated soils on arable farms. Although compost produced by home and community composting is more likely to be used locally, in household or public gardens, this may result in more compost being available elsewhere for agricultural use via market displacement. Communal home and community composting schemes could also provide compost (free or at a price) to local horticulture enterprises.

Side effects

Home and community composting has the objective of producing compost of a good quality which concerns three main aspects:

- organic amendment properties;
- fertilising effect;
- innocuousness of its application on land.

However, if home and community composting is not correctly implemented it may generate compost of a low quality, generating a negative environmental burden (IRSTEA, 2012).

Applicability

In cases when home and community composting is the most appropriate waste management option for biowaste, there are no major restrictions to implementing this BEMP. However, the success of home and community composting as an environmental management strategy is highly dependent on the management of the waste separation and composting process by citizens who must be first engaged to motivate them to separate organic waste, and then trained to correctly manage the composting process. Additional effort is required to organise home and community composting in urban areas.

Economics

Costs

Eunomia (2007) estimated the costs for the waste management company/authority for instigating household recycling (Table 2). The net cost of bins will depend on their specification, and whether, and at what level, householders are charged for them. Arcadis (2010) estimate that bin costs should not exceed EUR 25 per household, leading to a total annualised cost of just over EUR 2.50 per household to support home and community composting, assuming a bin lifespan of 10 years.

Table 2. Costs of instigating household composting

Cost item	Cost per household
Marketing, literature and support	EUR 6.76
Net bin cost (after sales revenue)	EUR 3.38
Delivery and storage	EUR 14.86
Annualised cost	**EUR 2.50**
Source: Eunomia (2007).	

The main cost to the householders is their time.

Benefits to the waste management organisation

Home and community composting avoids a number of costs for waste management organisations, most notably:

- waste collection costs;
- waste management or disposal (landfill) costs.

According to cost benchmarking data presented in the best practice on cost benchmarking (Section 0) provided by ia GmbH (2015), average waste collection and treatment costs amount to approximately EUR 80 per capita per year. It is difficult to estimate the proportion of these costs attributable to organic waste collection and treatment, but a crude estimation based on the 30 % relative mass of organic waste in MSW (Eurostat, 2014) would suggest that avoided organic waste handling costs could amount to approximately EUR 25 per capita per year.

However, in addition to avoiding costs associated with organic waste collection and treatment, the waste management organisation may also forego income from the sale of centrally produced compost, in the region of EUR 18/t (Aschaffenburg Local Authority, 2015).

Benefits to the compost user

Compost produced in home and community units can be used by householders in private gardens, housing associations or local authorities in public gardens. The fertiliser replacement value of compost based on food waste is displayed in Table 3.

Compost may be used as a substitute for peat or purchased compost products, leading to avoided purchase costs considerably greater than the fertiliser replacement value. These avoided costs are highly dependent on the type of product substituted.

Table 3. Fertiliser replacement value of compost derived from food waste, expressed per wet tonne of food waste (26 % dry matter)

Nutrient	Fertiliser nutrients replaced (kg per tonne of food waste)	Avoided fertiliser costs (EUR per tonne of food waste)

N	1.4	1.70
P_2O_5	0.6	0.65
K_2O	2.7	2.19
Total		**4.54**

Driving forces for implementation

Legislation and financial incentives to divert organic waste from landfill, established in EU Member States in response to Directives 1999/31/EC and 2008/98/EC, are major driving forces for the composting and anaerobic digestion of organic wastes. In countries that offer feed-in tariffs for renewable electricity, or other financial incentives for biogas production, economic factors may drive implementation of incineration with energy recovery and/or anaerobic digestion. Otherwise, economic factors may favour home and community composting as the cheapest option to divert organic waste from landfill.

Another important factor driving home and community composting is the fact that it counts as “waste prevention” under statistical accounting rules, because it avoids the collection and classification of “waste”. Thus home and community composting may count towards waste prevention targets established by local authorities and/or waste management companies, even though it does not achieve genuine waste prevention (and may in fact lead to higher environmental burdens than management options, such as anaerobic digestion, for collected waste: see BEMP on integrated waste management).

Reference organisations

Box 1 Example of support for home composting provided by Leicester County Council, UK

Leicester County Council established and supports the “Rot-a-Lot Compost Club”, a free-to-join home composting club that assists Leicestershire residents with home composting. Residents joining the club receive a member’s pack to help them get the most from their compost bins, including a kitchen caddy with biodegradable liners and a book about composting. Club members are kept up to date with club news and composting events through regular newsletters. Leicester County Council also distributes the WRAP guide to home composting: http://www.leics.gov.uk/composting_at_home.pdf.

Source: Leicester County Council (2015).

Box 2. Example of home and community composting implemented by SYBERT in Besançon, France

SYBERT is a waste management company in Besançon, France, that is pursuing a strategy of home and community composting. Owing to the absence of high feed-in tariff subsidies for bio-electricity and the high cost of collection, and possibly reflecting small local agricultural areas for digestate disposal, SYBERT did not pursue anaerobic digestion. It provided food collection boxes to all households to encourage composting. Single households were quick to take up composting, with 80 % now composting their organic waste. However, SYBERT had to invest significant resources in establishing over 230 community composting schemes throughout the city to cater for households in apartment blocks (described under “Operational data” above).

Nantes and Rennes are the only other examples of home and community composting that SYBERT know of in France.

Source: SYBERT (2015).

Box 3. Example of home composting and organic waste management promoted by Vlaco npo in Flanders

In Flanders, Vlaco npo supports and implements sustainable biowaste management, especially through home composting. Vlaco is a membership organisation with representation of both the Flemish government (OVAM and inter-municipal waste associations) and the private sector (private waste treatment companies). The 'Biocycling at home' unit of Vlaco focuses on raising environmental awareness concerning organic waste management via a twofold awareness approach.

An initial 'Home Composting' scheme evolved to the 'Closed Loop Gardening' scheme and finally, since 2012, the 'BioCycle at Home' scheme that includes communication about food losses and how to prevent them. The Vlaco unit 'Biocycling at Home' has trained several thousand volunteers called 'Master Composters' or 'Biocycle Volunteers' to assist the municipality in promoting recycling of food waste, lawn clippings and prunings via home composting and compost use, and chicken keeping. About 40 teachers are available to regularly train these volunteers and to update them. In total, 4 000 of those volunteers have been trained in the last 20 years. For the moment, 2 700 of these Master Composters / Biocycle Volunteers are still active (which is about 1 per 2 000 inhabitants). Volunteers are claimed to have better credibility compared with 'officials', as they have a rapport with local citizens.

Vlaco also approaches the public directly by: organising courses (about the prevention and processing of organic waste); (co?)organising campaigns and events (Closed Loop Weekend, Closed Loop Festival, Floralies 2016, etc.); distributing leaflets, brochures, posters (and booklets for those who want to know more about a specific theme); communicating by several types of (social, internet or paper) media, and through inter-municipal waste associations and local environmental services; using other educational materials (demonstration tools about processing organic residues, compost boxes and bins, wormeries, insect hotels, mulch mowers, wood chippers, school games, compost information box, etc.).

Results are tracked through screening of the behaviour of citizens every five years. In 1991, 5 % of the people in Flanders were composting at home. By 2012, this percentage had increased to 52 %. Vlaco estimate that 106 000 to 120 000 tonnes of organic waste is processed at home by composting, equating to between 16 kg and 19 kg per inhabitant per year. Their research indicates that 40 % of home composters are managing the process exactly according to best practice, and the vast majority of the home-produced compost is of an acceptable quality. 91 % of respondents that are compost at home do not experience problems with the composting itself or with the quality of the home compost. Almost all the compost produced is used at home.

Source: Vlaco npo (2015).

Box 4. Example of community composting in the province of Gipuzkoa, Spain

In November 2011, the first pilot project of community composting in the Basque Country (Spain) was launched in Usurbil (Gipuzkoa) and achieved a quick uptake by residents. By the end of 2013, 1 500 families in Gipuzkoa (600 000 inhabitants) were managing their food waste with community composting and there was a waiting list of 1 131 families. Today there are about 4 000 families in Gipuzkoa involved in community composting (up from zero in 2011) and many more doing home composting, since in the small villages the organic waste is no longer collected because it is all managed at source.

Source: Simon J. M. (2015).

Box 5. Example of Horta da Formiga training and awareness-raising for organic waste management in Portugal

Horta da Formiga is an educational farm managed by LIPOR in Portugal to educate citizens and institutions on the prevention and good management of organic waste, and also on good farming practices that can use composted waste. Horta da Formiga covers 1 hectare and includes demonstrations of composting bins and an organic kitchen garden.

The awareness-raising activities are free visits for groups of citizens, schools or other institutions, and a training service is provided comprising short theoretical and practical courses about composting, organic farming, sustainable gardening and sustainable cooking targeted at any citizen that intends to replicate the practices at home. The three-hour composting course is free.

More than 16 100 trainees have participated in the Horta da Formiga training plan since 2002, and more than 15 100 people have undertaken the home composting course. The farm has received over 26 500 visitors since 2002.

Source: Lopes A. (2015).

Communal home and community composting or district composting is realised in several cities or counties in Belgium (WORMS, 2015), Switzerland and Spain (Öko-Institut, 2012).

The county (Gemeinde) of Muttenz (Switzerland) offers assistance with information leaflets and a model contract concerning the maintenance of the district composting facility. Examples of leaflets are given in the links below (German language only):

- Infoblatt_Quartierkompost_Seemaettli.pdf;
- Infoblatt_Pflichtenheft_Quartierkompost.pdf;
- Infoblatt_Leitfaden_Quartierkompost.pdf).

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