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ASSESSMENT OF FEASIBILITY OF SETTING BIO-WASTE RECYCLING TARGETS IN EU, INCLUDING SUBSIDIARITY ASPECTS

FINAL REPORT

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Bio Intelligence Service - Scaling sustainable development
Industrial Ecology - Nutritional Health

Bio Intelligence Service S.A.S - bio@biois.com
20-22 Villa Deshayes - 75014 Paris - France
Tél. +33 (0)1 53 90 11 80 - Fax. +33 (0)1 56 53 99 90

Contacts

Laurent Franckx
laurent.franckx@vito.be

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1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

The objective of the current report is to complete and strengthen certain aspects of the knowledge base and the results of currently available studies on bio-waste, with a focus on the recent ARCADIS/Eunomia study. Furthermore any new data that became available recently have been taken into account.

1.2 METHOD

We have verified whether any other information that has become available since the finalisation of the ARCADIS/Eunomia study would lead us to revise the scenarios and assumptions that were used in that study.

Taking into account the short time span between the two studies, we have focused our “open” data search on some selected issues that we thought were especially relevant:

- The revised prospects for economic growth.
- New scientific insights on the relation between economic activity and waste generation.
- The costs of selective collection (including the administrative costs)
- Incentives for renewable energy, including biomass.
- Specific changes in the markets affecting compost use (such as fertiliser prices)

For the other topics, we have limited the active data collection to two sources of information:

- Sources that are readily available at the European level (Eurostat, EEA, the country fact sheets of the European Topic Centre on Sustainable Consumption and Production, etc...).
- The questionnaire submitted by the Commission in the context of the stakeholder consultation contains specific targeted questions.

1.3 REVISION OF THE BASELINE

1.3.1 PROJECTIONS FOR WASTE GENERATION AND TREATMENT

We have introduced three major changes in the baseline scenarios that were used in the ARCADIS/Eunomia study.

- **First**, we have used the inputs of the stakeholder consultation and new data to improve our projections of waste treatment wherever this was possible. In total, we have modified the baseline scenarios for twelve MS.
- The **second important change** is that we have used updated macro-economic and

demographic forecast.

- The **third important change** is that we have based our projections of MSW generation upon the most recent insights in the scientific literature. We have assumed an elasticity of waste generation with respect to consumption of 0.38, which corresponds to a very high level of relative decoupling.

1.3.2 EXPERIENCES WITH SELECTIVE COLLECTION AND BIOLOGICAL TREATMENT

Although in most countries, bio-waste recycling targets or separate collection requirements have only recently been established, the promotion of biowaste recycling and separate collection is receiving increased attention. Nevertheless, some Member States still focus most of their efforts on diverting waste from landfill in order to meet the targets of the Landfill Directive, rather than on improving resource efficiency and material recycling. Waste management investments in these countries are mainly directed towards incineration and Mechanical Biological Treatment.

Nevertheless, the potential of anaerobic digestion for simultaneously producing biogas and a soil additive is increasingly being recognised.

As for encouraging separate collection, the measures taken differ widely between Member States.

The following barriers to the implementation of separate collection and recycling of biowaste have been reported as being the most important:

- A general lack of experience and knowledge about the benefits of recycling/separate collection, the methods to set up a successful collection scheme, the cost structures, the ways to ensure compost/digestate quality, the uses of compost/digestate, the market functioning of waste-derived products such as compost, etc.
- The current waste management infrastructure and practices.
- The costs linked to separate collection and recycling (although most statements on these issues do not appear to be grounded in facts).
- Political barriers, which are mostly (but not uniquely) associated with the factors mentioned above.
- Logistical and social issues, mainly in rural areas and city centres.

This shows that the best waste treatment and collection system is dependent on the local circumstances. Local flexibility is thus indispensable for any policy measure aiming at encouraging bio-waste recycling. EU-level targets focussing on the national levels are believed to maintain such flexibility at the local level.

The stakeholder consultation has revealed that several misunderstandings have arisen regarding the exact scope of the proposed target. These ambiguities refer to definition of bio-waste, of recycling of separate collection as well as to the level of target setting (local/national).

Although substantial environmental improvements are to be expected from the full implementation of the current legislation, several stakeholders have argued that there are important gaps in the existing legislation. If national target would to be set, they should leave sufficient flexibility at the local level. Some concerns have been expressed with respect to the need to leave sufficient flexibility for new technologies. Clear calculation and monitoring guidelines have been called for as well.

Some stakeholders have argued that the scope of recycling target should be broadened, both on the output side (e.g. include the re-use of biowaste in animal feeding) and on the input side (include waste from the food processing industry).

The following advantages of separate collection targets as compared to recycling targets are:

- They leave more flexibility to the Member States to choose the environmentally and economically best technological treatment option, adapted to the local circumstances.
- They leave room for technological innovation
- Separate collection is believed to be an important prerequisite for high quality compost/digestate, and quality is key for ensuring a well-developed compost market.
- The data requirements for monitoring the progress and compliance with the target would be less demanding.

On the other hand, a separate collection target is less result-oriented than a recycling target and the environmental benefits associated with bio-waste treatment are based on high quality results. New or future technological developments might lead to good quality results, without the need for separate collection. The fact that separate collection does not necessarily lead to recycling could also constitute a disadvantage.

1.3.3 OTHER ISSUES

Local markets for compost are present nearly everywhere, besides a few areas in Europe with high density of livestock inducing competition with manure. Moreover, different compost grades have a different market value and it is claimed that for high quality composts even transportation over large distances may still be viable. Local soil conditions do not appear to have a major impact on the markets for compost. However, it was confirmed that high compost quality is essential for increasing user confidence. In general, the trend for the prices of mineral fertilisers is upward, which should improve the long-term market prospects for compost¹.

As the JRC has just published a first working document on end-of-waste criteria, we cannot yet assess their full impact on the market potential for compost.

Finally, the problems to be expected from the diversion of biowaste from incineration seem to be quite limited.

In the vast majority of MS, the national support schemes for renewable energy have remain unchanged. Wherever changes have been introduced, it was mostly in the direction of increased support (including for energy from biomass).

A new review of the literature has confirmed that information on the logistical costs of separate collection cannot easily be generalised, but that these costs can be very low when the logistical processes are optimised. We have therefore maintained the approach to assume zero costs of separate collection (although we have compared the range of estimates provided in the literature with the net benefits of biowaste recycling targets – see further).

¹ The text above is essentially a succinct summary of the Barth et al. (2008) report, which was also the main input for the JRC report on EoW criteria.

1.3.4 REVISED BASELINE

Table 1 provides an overview of the new projection of biowaste at the EU27, and the corresponding waste treatment methods.

Table 1: Updated baseline scenario at the EU27 level (ktonnes)

Year	landfill	incineration D10	incineration R01	MBT	composting	backyard composting	anaerobic digestion	total biowaste collected
2013	21.192	714	14.115	16.559	26.558	4.431	5.122	88.692
2014	20.296	721	14.219	17.504	27.101	4.611	5.663	90.116
2015	19.511	728	14.610	17.781	27.742	4.810	6.136	91.319
2016	17.588	735	14.750	19.134	28.400	5.067	6.628	92.301
2017	16.971	0	15.785	19.160	29.004	5.228	7.141	93.288
2018	16.548	0	15.861	19.218	29.641	5.399	7.620	94.286
2019	15.812	0	16.233	19.243	30.304	5.574	8.128	95.294
2020	14.666	0	16.341	20.244	30.872	5.685	8.503	96.311
Total	142.586	2.899	121.914	148.843	229.620	40.805	54.941	741.607

Table 2: ARCADIS/Eunomia baseline scenario at the EU27 level (ktonnes)

	landfill	incineration	MBT	composting	backyard composting	anaerobic digestion	total biowaste collected
2013	24.347	20.513	19.652	22.124	1.047	4.073	91.755
2014	22.832	20.765	20.778	22.909	1.120	4.457	92.861
2015	21.636	21.401	20.937	23.674	1.198	4.857	93.703
2016	19.247	21.631	22.445	24.430	1.278	5.272	94.304
2017	18.440	22.030	22.198	25.169	1.355	5.704	94.896
2018	17.837	22.033	22.114	25.962	1.440	6.103	95.489
2019	16.651	22.584	21.989	26.749	1.531	6.520	96.024
2020	15.122	22.553	22.772	27.600	1.627	6.885	96.558
Total	156.111	173.510	172.885	198.617	10.595	43.873	755.591

Compared to the baseline scenario that was presented in the ARCADIS/Eunomia study (Table 2), the following differences are noteworthy:

- In the ARCADIS/Eunomia study, total bio-waste generation between 2013 and 2020 was projected to be 755.591 ktonnes. The current projection thus involves a decrease of 1.85% compared to the previous scenario. This small change reflects, on the one hand, significantly worse macro-economic prospects for the forecast period, and, on the other hand, a new approach to modelling the relationship between economic activity and waste generation.
- However, for some individual treatment methods, the differences between the two models are very important. These differences reflect the new information that was provided in the stakeholder consultation but do not result from any fundamental change in waste management approaches since the previous report was published. For instance, it is our conjecture that, in most member states, the actual amounts of biowaste that are composted at home are still significantly higher than projected here,

but are simply not reported.

- Compared to the ARCADIS/Eunomia study, there is a very pronounced decrease in the amounts that are incinerated (28%).
- Despite the reduction in waste generation, we observe a 28% increase in the quantities of biowaste that are recycled (home composting included). This reflects again the new information that was provided during the stakeholder consultation.

Globally speaking, we have thus a baseline scenario that is much more favourable than in the ARCADIS/Eunomia study, both in terms of waste quantities generated and in terms of the way they are treated.

These changes confirm that, in the absence of standardised reporting requirements at the EU level, estimates of the total mass flows treated with a specific waste treatment technology remain very uncertain. However, the estimates of these mass flows can significantly affect the benefits of the policy scenarios.

1.4 REVISION OF THE COST-BENEFIT ANALYSIS

In this report, we have considered two possible targets. No prevention is assumed to take place. We have used the same unit costs as in the ARCADIS/Eunomia study.

This first target required that each MS would achieve 60% food waste capture and 90% garden waste capture by 2020.

Under this target, 88 million tonnes of waste is removed from residual waste treatment facilities compared to the baseline. By 2020, 27 million tonnes of additional annual biowaste treatment capacity will be needed at the EU27 level to accommodate this shift.

This target 1 results in a net benefit (abstracting from collection costs) of almost 3 billion EUR for the EU27 over the period 2013-2020. 80% of this benefit results from improvements in the environment.

Moreover, with this target, we would achieve a reduction in GHG emissions of slightly more than 7 million tonnes of CO₂eq if we include biogenic CO₂ emissions, and of slightly more than 6 million if we exclude biogenic CO₂ emissions. These reductions in GHG emissions corresponding to less than 0.6% of the difference between the 2020 “with existing measures” projections and the 2020 targets for the EU27.

This second target corresponds to scenario III in the ARCADIS/Eunomia study (36.5% separate biowaste collection by 2020).

Under this target, 21 million tonnes of waste is removed from residual waste treatment facilities compared to the baseline. By 2020, 5 million tonnes of additional annual biowaste treatment capacity will be needed at the EU27 level to accommodate this shift. As this is less than 20% of what was required under target 1, this confirms that the level of ambition of target 2 is much lower than the level of ambition of target 1.

Target 2 results in a net benefit of almost 668 million EUR for the EU27 over the period 2013-2020. Almost 80% of this benefit results from improvements in the environment. We also find that under

Target 2, we achieve a reduction in GHG emissions of almost 2 million tonnes of CO₂eq if we include biogenic CO₂ emissions, and of slightly more than 1.5 million if we exclude biogenic CO₂ emissions.

The realisation of target 2 would lead to reductions in GHG emissions corresponding to less than 0.2% of the difference between the 2020 “with existing measures” projections and the 2020 targets for the EU27.

1.5 OTHER ISSUES

1.5.1 DISTRIBUTIONAL EFFECTS

We have considered the following distributional aspects of the separate collection and recycling of biowaste:

- The impacts on the employability of lowly skilled workers
- Regions with low population density and urban areas
- Countries with very warm climates
- Climates unsuitable for windrow composting
- The regional differences in soil quality (and thus in needs for compost)
- The competition with manure

Most of these distributional issues seem to be relatively minor. They can easily be dealt with if the following conditions are met:

- Enough flexibility should be left to the Member States with respect to the implementation of the national target.
- A well functioning international market for compost is established, which requires a EU standard for compost.

1.5.2 ADMINISTRATIVE COSTS

It has been estimated that the administrative cost of separate biowaste collection corresponds to the gross fee, overhead and working costs for 4.3 FTE per one million citizens.

1.5.3 COUNTRY SPECIFIC CIRCUMSTANCES

Let us now discuss some other arguments that have been put forward in favour of differentiated targets².

First, income levels. There is ample evidence that income levels affect not just waste generation, but also the relative shares of landfilling, material recovery and incineration. A combination of factors (inheritance of the past and difficult access to capital markets) could explain why lower income countries will be slower to move to recycling than high income countries.

² In this context, differentiated targets must be understood as “different target levels for different member states” rather than targets that are differentiated in time.

Whilst this does not provide an argument in favour of differentiated targets in the long run, it is clear that one possible way to accommodate this would be to introduce differentiated compliance dates, as is currently the case with the diversion targets of the Landfill Directive.

Financial support from the instruments of the EU cohesion policy could alleviate the problems related to limited access to capital markets.

Second, environmental awareness. There is some evidence that (a) environmental awareness varies widely between the MS of the EU (b) that this awareness affects recycling.

All in all, differences in environmental awareness do not call for differentiated targets. However, they do point to the need for extensive environmental education and awareness raising. Moreover, this is typically an area where regions and cities who would create a system of selective collection could learn from the experience of the forerunners. The Commission could play an active role in the dissemination of this experience.

Third, the availability of other renewable energy sources than biodegradable waste. In countries with relatively abundant renewable energy (such as hydropower) from other sources than biowaste, biowaste is relatively less interesting than in countries with few sources of renewable energy. The ARCADIS/Eunomia study had already taken this into account: both the financial and the environmental assumptions depend on the existing energy mix within each country and on the existing support schemes. Moreover, the ARCADIS/Eunomia study had considered country-specific uses of biowaste as a source of renewable energy.

These local influences are only important to the extent that European energy markets are not yet fully integrated and interconnected. The need for an integrated European energy network is however an issue with ramifications far beyond biowaste policy.

Fourth, the existence of “sunk” investments in specific waste management options (such as incinerators). The ARCADIS/Eunomia study had shown that, to the extent that existing incineration capacities are indeed sunk³, there is a net cost to society in closing down existing incineration capacity to build new biowaste treatment facilities where the capital cannot be put to any useful alternative purpose. However, the stakeholder consultation undertaken in the context of the current study has revealed that none of the concerns discussed in the ARCADIS/Eunomia study will turn out to be very relevant in practice.

1.5.4 EMERGING TECHNOLOGIES

Some stakeholders have expressed a concern that a bio-waste recycling target focusing on composting and AD would ignore the potential benefits of other innovative ways of gaining energy from bio-waste, such as biorefining.

The IEA Bioenergy Task 42 on Biorefineries has defined biorefining as the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat) . The biomass can be waste streams or crops.

³ I.e., the investment costs cannot be recovered when one moves waste away from incineration to other waste treatment options.

It is expected that this market segment will grow in the future and that this will affect the composition, the amounts and the use of different biomass waste streams.

The current state of knowledge does not allow us to go beyond some general qualitative statements on how biorefining compares to composting and AD, both in terms of environmental impacts and in terms of costs. For instance, in terms of environmental impacts, biorefining is expected to lead to lower emissions of GHG than composting. Moreover, it would lead to a higher share of organic products. A drawback of biorefining compared to compost is that it would contribute less to the fight against soil degradation and to the improvement of soil quality and productivity.

Moreover, the generic terms “biorefining” refers to a wide range of very diverse processes – therefore, the comparison needs to be made on a case-by-case basis. For instance, whether separate collection is a prerequisite for biorefining depends on the details of the specific process.

Therefore, it is not possible yet to assess the impact of biowaste recycling targets (where recycling would be limited to composting and AD), neither on the performance of the biorefining industry, nor on the environment .

The most appropriate attitude would be to adopt a flexible attitude to the processes that can be included in a biowaste target. A legislative measure in this field could start with a limitative list of processes that are considered “recycling”, but would also include a clause that requires a regular revision of this list, taking into account new scientific and technological development. If the legislative instrument would describe the criteria used to assess whether a specific process can be considered as “recycling”, the revision of the list could be made subject to a comitology procedure.

1.6 CONCLUSION

In this study we have verified the rationale behind the proposed targets for bio-waste recycling.

Using new data and stakeholder feedback that has become available since the finalisation of the ARCADIS/Eunomia study, we have described and analyzed the expected economic, social and environmental impacts of these targets. We have verified whether there are reasons to propose a new target or targets based on the specific situation of MS and/or subsidiarity issues.

Our analysis has confirmed that the magnitude of the net benefits of biowaste recycling targets depends to a large extent on the baseline scenarios. However, this revision of the baseline has not led to a fundamental revision of previous study results: both targets bring net benefits at EU27 level. Depending on the ambition of the target, these benefits range from several hundreds of million EUR to several billion EUR.

For the vast majority of estimates of the costs of separate collection, the net benefits of bio-waste recycling exceed the costs. The literature has also confirmed the need for a thorough optimisation of the collection scheme – it would certainly benefit authorities that start a new system of separate collection to learn from the experiences of others.

1.6.1 FORMULATION AND LEVEL OF THE TARGETS

In reality, several complications will need to be confronted when defining targets.

First, in case the targets are defined in terms of recycling performance (rather than in terms of separate collection), some stakeholders have argued that the definition of “biowaste recycling” should be broadened, and should include the re-use of biowaste for animal feeding. Other stakeholders have pointed to emerging treatment options, such as biorefineries, which may well suffer from a restrictive definition of “biowaste recycling”. One way to accommodate these concerns in a recycling target would be to start with a limitative list of processes that are considered “recycling”, but would to require a regular revision of this list, taking into account new scientific and technological development. If the legislative instrument introducing the target would describe the criteria used to assess whether a specific process can be considered as “recycling”, the revision of the list could be made subject to a comitology procedure. This would leave room for innovation.

Alternatively, defining the targets in terms of separate collection without imposing a specific recycling technology, would automatically accommodate the concerns discussed in the previous paragraph. The risk that separately collected biowaste still ends up in landfills, incinerators or MBT facilities seems limited. Separate collection targets would thus provide stronger incentives for innovation.

One drawback of “separate collection” targets is that some future technologies may no longer require separate collection. Again, a way to accommodate this possibility, is to introduce a revision clause in the legislative instrument, or to delegate these matters to a comitology procedure.

A second issue which inputs should be considered in the definition of the target. Some stakeholders have argued in favour of including bio-waste from the food processing industry in a recycling target. However, setting a collective target for municipal and industrial waste would not accommodate the important differences between the two categories of waste streams. Moreover, the data gaps in the field of industrial waste are even more important than in the field of municipal waste.

Concerning the level of the targets, we have shown that any target going below the “low ambition” target would go below what would already be achieved by half of the MS in 2020, and would still be 10% lower than the EU average. Its net effect on total biowaste recycling in the EU27 would be really small. For instance, for a 30% target, total recycling would increase from 46,79% to barely 50,18%.

Conversely, a target of around 70% would require almost all MS to perform better than what is expected in the baseline, and can therefore be considered to be an indication of the maximum that can effectively be achieved. This corresponds to the “high ambition” target of the ARCADIS/Eunomia study (but without the prevention effects).

Our analysis has confirmed that the net benefits (excluding collection cost) of a “high ambition target” would be more than four times larger than the net benefits of a “low ambition target”, even though we have no longer allowed for prevention effects. Therefore, any argument that the target should be lower than the high recycling target should be based upon costs that have not been addressed in the ARCADIS/Eunomia study. To the extent that costs of recycling targets have been reported during the stakeholder consultation, it was only in qualitative terms. Moreover, some arguments mainly show that an immediate transition is not feasible. The stakeholder consultation has revealed very little concrete information⁴ that these “high ambition targets” (or targets that would come close to these “high

⁴ Generally speaking, the countries that have limited or no experience with the separate collection of biowaste have also provided very little information on the concrete problems they are facing (or think they will face) with the implementation of separate collection. It is thus possible that some real barriers

ambition targets”) would be infeasible, allowing for a long enough transition period. Therefore, both problems (the lack of concrete info and the time required to invest in alternative systems) can be tackled through the gradual approach we propose below,

Our recommendation would be therefore to proceed in two steps.

First, set a “low ambition target” for 2020 (such as “target 2” in this study). This would enable member states to concentrate on the easy-to-collect waste streams, to gain experience with biowaste management, to exchange good practices with other member states and to build up the necessary infrastructure. By 2020, sufficient insight should also have been gained in the properties of emerging treatment technologies (see section 6.4) to make an assessment of whether they should be considered as “recycling” technologies or not. By not setting an overly ambitious target by 2020, one could thus avoid lock-in effects.

Second, in the longer run (say 2025-2030), a more ambitious target should be aimed at, which should be set closer to “target 1” as defined in the study.

1.6.2 FLEXIBILITY

There are several factors (mostly the spatial structure) that call for flexibility in the setting of biowaste recycling targets at the local level. However, there is no contradiction between a global target at the country level and flexibility at the local level. It could be left to the MS to decide how to allocate the recycling efforts within the territory, possibly through a system of tradable permits. If home composting would be included in the targets, this could help rural areas with very low population densities – however, this then raises the specific concern of quality control. Alternatively, Member States could be allowed to ask for an exemption for “isolated settlements” (for instance, such as they have been defined in Article 2 of the Landfill Directive⁵) – the procedure for this exemption could then follow Article 3 of this Directive.

There are also local differences in the need for compost. On the one hand, there are significant differences in soil quality across the EU. On the other hand, in some regions, the high density of livestock implies that compost cannot be applied to agricultural land. However, in case no local market for compost is present, long distance transport might be viable for high grades. This confirms the importance of having high quality compost as a pre-requisite for market confidence.

There is one important factor that calls for differentiation between MS: the current state of their waste management infrastructures and policies. However, this does not imply that the final targets should be different, but that a sufficiently long transition period should be foreseen, and that this period should be longer for countries that have a longer way to go.

1.6.3 ROLE OF THE EU

What role could the EU play in biowaste management, independently of the issue of (recycling or collection) targets?

have not been documented in this study. However, in the absence of any concrete information, a discussion of these barriers would be purely speculative. All stakeholders have received ample opportunities to document these barriers.

⁵ Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

First, one essential prerequisite for the further development of markets for compost is increased market confidence and lower transaction costs. Therefore, there is a clear case for end-of-waste criteria and corresponding European standards for compost, whether or not recycling or collection targets would be introduced.

Second, there is a strong case for the dissemination of good practices and awareness and information campaigns. This is definitely an area where the EU could play an important role, both to bring stakeholders together and to support these activities actively.

Third, several important misconceptions exist concerning the nature of the proposed targets. This shows that the Commission needs to communicate clearly on its actual intentions and take away any misunderstandings concerning the proposed policies.

Fourth, although we have identified no hard evidence that specific MS will not be able to reach the diversion targets of the Landfill Directive, a rigorous monitoring of the full implementation of current legislation is also important.

Finally, whatever targets would be finally chosen (if any) in a legislative proposal, clear calculation and monitoring guidelines are required to limit the administrative burdens.

1.6.4 QUALITY OF DATA AND METHODOLOGICAL ISSUES

The current study has confirmed the general lack of reliable and verifiable information on biowaste generation and management.

Despite the very targeted questions that were submitted in the stakeholder consultation, most answers were essentially opinions, and contained very few quantitative facts that can be subjected to an independent verification.

With the data that are currently available at the level of the EU, different econometric approaches to the forecasting of MSW can lead to quite different results. Therefore, any forecast of MSW should be interpreted with circumspection. This confirms the need for standardised reporting requirements, not only for waste generation but also for waste treatment, split up per major waste category. A more general conclusion is the need for models that forecast waste generation based upon surveys of individual households, rather than upon macro-economic data.

2 INTRODUCTION

2.1 AIMS, OBJECTIVES AND DELIVERABLES

The objective of the current report is to complete and strengthen certain aspects of the knowledge base and the results of currently available studies on bio-waste, with a focus on the recent ARCADIS/Eunomia study⁶. Furthermore any new data that became available recently have been taken into account.

2.2 BACKGROUND

The Environmental Directorate-General of the European Commission is currently assessing the existing and future management options for bio-waste. The first step in this process was the publication of a Green Paper on the management of bio-waste in the European Union, followed by a stakeholder consultation.

The second step was the preparation of an impact assessment of a potential legislative proposal. This assessment looked into ways to improve the management of bio-waste in the EU Member States (MS). Its aim was to provide an appropriate assessment of different policy options with a focus on environmental, economic and social impacts and a special emphasis on prospective risks and opportunities. A study by ARCADIS/Eunomia has assisted the Commission's impact assessment. This study defined different policy options and assessed their environmental, economic and social impacts.

The final step up to this point has been the publication of a communication from the Commission to the Council and the European Parliament on future steps in bio-waste management (COM(2010)235 final, hereinafter referred to as "the Communication"). In the Communication, it is stated that the potential benefits of the recycling of bio-waste appear to be significant, but that further work is needed, particularly from the subsidiarity perspective, before considering an EU target for biological treatment. Therefore the Commission wants to strengthen the analysis that has already been made with special attention given to the following aspects:

- Will all MS meet the **diversion targets of the Landfill Directive** with respect to biodegradable municipal waste (BMW)? As requested by its Terms of Reference, the previous study had assumed that they would. However, doubts have been raised with respect to the realism of this assumption. If the countries that would not meet the diversion targets under the business-as-usual approach would meet these targets with a revision of the recycling targets under the Waste Framework Directive, then the figures reported in the ARCADIS/Eunomia study underestimate the benefits of these targets. One possible reason could be that such targets, by being more specific than the Landfill Directive, would create a stronger incentive for recycling. This raises the question how the conclusions of the previous study would be affected were several MS not to meet the targets.
- **More attention to the subsidiarity aspect.** The analysis in the ARCADIS/Eunomia study

⁶ <http://ec.europa.eu/environment/waste/compost/developments.htm>

has only considered uniform targets for all MS. However, as was pointed out repeatedly in the study, circumstances vary across MS, and this raises the possibility of differentiating the targets (or the timing of their achievement) according to these circumstances. Also, the ARCADIS/Eunomia study has not considered the actual policies at the MS level that would be needed to achieve the proposed targets.

- Cost related to the **separate collection of bio-waste** and its impact on trade-offs among treatment methods. The ARCADIS/Eunomia study had not considered the logistical costs of separate collection because an extensive literature study had shown that the cost of separate bio-waste collection varies considerably according to local circumstances, noting it can be undertaken with zero additional costs *if it is optimised*. The results of this literature study need to be compared with any new findings on the topic.

More specifically, in the Commission Staff Working Document accompanying the Communication (SEC(2010)577 final – hereinafter “the Working Document”), it was concluded that the “optimal” combination consists of promoting a moderate target for prevention (similar to Scenario 2 in the ARCADIS/Eunomia study) and another target for biological treatment (minimum of 36.5% as proposed in Scenario 3 in the ARCADIS/Eunomia study).

The Commission now wants to strengthen the analysis given in the Communication, in particular with respect to the following aspects:

- Problems implementing existing legislation;
- Subsidiarity issues;
- Value-added of setting bio-waste recycling and/or separate collection targets; and
- Rationalizing the level of bio-waste treatment targets.

2.3 PROJECT TEAM

The study has been conducted by the consortium VITO (project lead) in association with BIO Intelligence Service (BIO) and ARCADIS.

	• Laurent Franckx (Project Director) • Katrijn Alaerts • Stella Vanassche
	• Véronique Monier • Mathieu Hestin
	• Mike Van Acoleyen • Ilse Laureysens

The project website is at <https://sites.google.com/a/biois.com/biowaste/home> .

3 METHOD

3.1 KEY PROJECT MILESTONES

The key project milestones and timeline are below.

TIME	ACTIVITY
January 2011	Inception Meeting & Minutes
01 February 2011	Website live
07 February 2011	Finalisation stakeholder consultation
04 March 2011	Draft final report
07 March	Stakeholder meeting
04 March 2011	Final report

3.2 DATA SOURCES

We have verified whether any other information that has become available since the finalisation of the ARCADIS/Eunomia study would lead us to revise the scenarios and assumptions that were used in that study.

The list of elements that are candidates for an update is potentially very long: revision of the prospects for economic growth, revision of some national support schemes for renewable energy, changes in EU energy policy (including with respect to the integration of national infrastructures), impact of the new Directive on Industrial Emissions, developments in the EU soil strategy, revised official figures on municipal waste generation in general (or biodegradable municipal waste in particular), new information on the relative share of treatment methods, specific data on the relative share of garden waste and kitchen waste, additional information on the Member States' policies (and policy intentions), changes in prices (for instance, of compost and energy sales)...

However, within the resources and timeframe of this study, a comprehensive new data collection, going back to original sources, was not possible. Moreover, taking into account the short time span between the two studies, most (publicly available) information has remained unchanged anyway.

We have therefore focused our "open" data search on some selected issues that we thought were especially relevant:

- The revised prospects for economic growth.
- New scientific insights on the relation between economic activity and waste generation.
- The costs of selective collection (including the administrative costs)
- Incentives for renewable energy, including biomass: some national support schemes

have been subject to changes, and a revision of the Energy Taxation Directive is in its final stages. We have verified that information that is available on the subject with the assumptions used in the ARCADIS/Eunomia study. However, as support schemes only affect private costs and not social costs, no formal modelling on this issue has been undertaken.

- Specific changes in the markets affecting compost use (such as fertiliser prices)

For the other topics, we have limited the active data collection to two sources of information:

- Sources that are readily available at the European level (Eurostat, EEA, the country fact sheets of the European Topic Centre on Sustainable Consumption and Production, etc...).
- The questionnaire submitted by the Commission in the context of the stakeholder consultation contains specific targeted questions.

The consultation has for instance been used to gather information on the experiences of the MS with selective collection and biological treatment of bio-waste. The potential markets for the treated bio-waste have already been analysed at length in a recent report by Barth et al (2008). We have therefore not undertaken any new active data collection on this issue. Instead we have used the validation process to verify if concrete new elements have become public since the publication of the study by Barth et al. The focus has been on the following elements:

- How do transportation costs affect the potential uses for compost (both within a country and internationally)?
- How does the competition with manure as a fertiliser affect the market potential for compost within a country?
- To what extent do local soil conditions affect the market for compost?
- How do concerns with respect to the quality of the compost affect its potential uses?

Another area where additional information has been sought through the stakeholder consultation is on the use of incineration:

- What is the current incineration capacity in a given country?
- When is it expected that this capacity will reach the end of its economic lifetime?
- What alternative sources of waste are expected to end up at those incinerators if there was a move away from incineration to biological treatment?

The main objective of this additional information was to assess the extent to which existing incineration capacity can be considered as “sunk”.

Taking into account the results of the data collection in the ARCADIS/Eunomia study, we have not sought to obtain new data on industrial biowaste.

3.3 OUTLINE OF THE REPORT

This report is organised as follows.

Chapter 4 contains a summary of all the information that has been gathered on top of what was already present in the ARCADIS/Eunomia study. More specifically, it contains new projections for waste generation and treatment, a discussion of the national support schemes for renewable energy (including biomass) and an overview of recent studies related to the costs of selective collection. We also discuss experiences with selective collection and biological treatment, markets for compost, the relationship between incineration and biological treatment and issues with the Landfill Directive. The chapter concludes with a summary of the revised baseline scenarios. The new baseline scenarios are much more favourable than in the ARCADIS/Eunomia study, both in terms of waste quantities generated and in terms of the way they are treated.

Chapter 5 presents the new cost-benefit analyses, for two scenarios: a “high” recycling and a “low” recycling scenario. This analysis uses the renewed baseline scenarios as a reference point. It concludes that a target at the EU level brings substantial financial and environmental benefits. These benefits are however significantly lower than those estimated in the ARCADIS/Eunomia study. This shows that the magnitude of the benefits depends to a non-negligible extent on the baseline.

Chapter 6 discusses miscellaneous topics: the potential distributional effects of biowaste policy, the administrative costs and the extent to which country-specific circumstances should be taken into account in setting policy.

Chapter 7 concludes.

Annex A contains a detailed discussion of the results of the stakeholder consultation that was organised by the European Commission, while Annex B summarizes the findings of the workshop that has taken place on 7 March.

4 REVISION OF THE BASELINE

4.1 PROJECTIONS FOR WASTE GENERATION

We have introduced three major changes in the baseline scenarios that were used in the ARCADIS/Eunomia study⁷.

First, we have used the inputs of the stakeholder consultation and new data to improve our projections of waste treatment wherever this was possible.

The following specific changes have been introduced:

- In the Czech Republic, the separate collection of green municipal waste is now a minimum duty for the municipalities. This policy change is reflected in the baseline percentages of separate collection.⁸
- In Denmark, 95% of food MSW is currently incinerated and 95% of green waste is composted. However, in the future, 35% of green waste will be incinerated. This is reflected in the baseline percentages of separate collection and of biological waste treatment.⁹
- In Estonia, an incineration plant with a capacity of 220 ktonnes per year is planned. MBT facilities of the same capacity are also in the pipeline. This is reflected in the baseline shares of residual waste treatment methods.¹⁰
- In Finland, the National Waste Management Plan requires the generation of MSW to stabilise as from 2016 on. Moreover, the major part of green waste goes to backyard composting.¹¹
- In France, 4300 ktonnes of green waste is collected separately and composted. 5100 ktonnes are composted at home, and 600 ktonnes are collected as mixed waste.¹² The

⁷ We have also introduced some changes of purely technical nature in order to ensure that all mass flows remain non-negative whatever the values of the exogenous variables. These changes are not further discussed in this report.

⁸ Stakeholder consultation, comments from CEE Bankwatch Network and Friends of the Earth Czech Republic.

⁹ Stakeholder consultation, comments from the Danish Environmental Protection Agency.

¹⁰ Josef Barth (ECN), personal communication and Peter Eek, presentation on the workshop of 07/03/2011.

¹¹ ETC/SCP, country factsheets on waste policies, 2009 edition. Available at: http://scp.eionet.europa.eu/facts/factsheets_waste/2009_edition. Stakeholder consultation, comments from the Association of Finnish Local and Regional Authorities.

¹² Stakeholder consultation, comments from FNADE.

baseline percentages have been adapted to reflect this. Note however that the total amounts do not correspond to the totals we have obtained from other sources.

- We have been informed that home composting plays a more important role in Italy than reported in the ARCADIS/Eunomia report.¹³ This is now reflected in the baseline percentages for biological waste treatment.
- In the Netherlands, 2317 ktonnes of green and park waste is composted. 81 ktonnes has been digested anaerobically. However, 611 ktonnes of AD capacity had been licensed by the end of 2009.¹⁴ We assume that these will gradually been put into operation.
- In Portugal, total forecasted MBT capacity is 420 ktonnes by 2013, and 1000 ktonnes by 2016.¹⁵ The baseline percentages for residual waste treatment have been adapted to reflect this.
- In Slovenia, the selective collection of household bio-waste is mandatory from 2011 onwards.¹⁶ The baseline percentages for selective collection have been adapted to reflect this change.
- In Spain, 8199 ktonnes of mixed waste (non-bio fraction included) is composted annually.¹⁷ This is reflected in the baseline shares of residual waste treatment methods.
- In Sweden, 40 % of bio-waste is now recycled.¹⁸ The baseline percentages for selective collection have been adapted to reflect this change.
- In the United Kingdom, 4421 ktonnes of bio-waste are treated biologically, 1264 ktonnes are incinerated, 5462 ktonnes are landfilled and 352 ktonnes are treated in MBT facilities.¹⁹ All the baseline percentages have been modified accordingly.

Note that some of these figures conflicted with figures from other data sources, and this is reflected in the corrections we have introduced. The resulting quantities must thus be interpreted as gross approximations.

¹³ Christian Garaffa (Novamont), personal communication and European Bioplastics (2010), Factsheet home composting.

¹⁴ Stakeholder consultation, comments from the Netherlands. Agentschap NL (2011), Nederlands Afval in Cijfers. Werkgroep Afvalregistratie (2010), Afvalverwerking in Nederland, gegevens 2009.

¹⁵ Pires, A., Silveira, A. & Martinho, M.G. (2010). MBT and Anaerobic Digestion in Portugal – A Concept to Meet EU Landfill Directive Targets. Presentation at the 8th ASA waste days, Hannover, 2010.

¹⁶ Stakeholder consultation, comments from ECN, Arge and KGVÖ.

¹⁷ Stakeholder consultation, comments from Spain.

¹⁸ Stakeholder consultation, comments from the Swedish Ministry of Environment.

¹⁹ Stakeholder consultation, comments from the United Kingdom, SEPA and AfOR. Northern Ireland Municipal waste management statistics, Annual Report 2009/10. Defra, Municipal waste arisings from 2000/01 to 2009/10. SEPA (2010), Waste Data Digest 10: Key facts and trends. WAG (2010), Municipal Waste Management Report for Wales, 2009/10. AfOR (2010), Survey of the UK organics recycling industry 2008/09.

The **second important change** compared to the ARCADIS/Eunomia study is that the economic outlook for the EU27 has changed dramatically in the last three years. The long-term economic forecasts that were used in the ARCADIS/Eunomia study did not yet take into account the longer term consequences of the financial crisis.

For the purposes of this study, we have used the 2009 update of “EU Energy trends to 2030”, published by the European Commission, DG Energy²⁰.

The new demographic and economic forecast could readily be applied to all EU27 countries²¹, with the exception of Belgium, where we needed regional forecasts²². The Belgian Federal Planning Bureau publishes regionally differentiated demographic forecasts for the whole period covered by this study, and these could be applied as such²³. For the macro-economic aggregates, we had to resort to national per capita figures and growth projections²⁴. While this approach is not perfect, the lack of regionally differentiated macro-economic forecasts beyond 2015 left us without a choice on this issue. Taking into account the relatively small size of the Belgian economy, this simplification is unlikely to have a major impact on the EU27 forecast (and to be insignificant compared to the other sources of uncertainty in this study).

The **third important change** relates to the functional relationship between macro-economic indicators and waste generation. In the ARCADIS/Eunomia study, three possible functional specifications were simulated for the relationship between GDP per capita and MSW generation per capita. For each MS, expert judgement was used to identify the most relevant specification.

Since the ARCADIS/Eunomia study was finalized, new empirical research results on this issue have been published in the scientific literature^{25, 26, 27}. We briefly summarize these results here and we then explain how we have used them for the purposes of the baseline scenarios.

The objective of an econometric study of waste generation is to estimate the numerical values of the coefficients of an equation such as:

$$\ln \text{Waste per capita}_{it} = \beta_{0i} + \alpha_t + \beta_1 \ln C_{it} + \beta_{0i} \ln C_{it}^2 + \beta_{0i} X_{it} + \beta_{0i} Z_{it} + e_{it}$$

²⁰ http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf

²¹ The DG Energy report only provides absolute values for 2000, 2010 and 2020. For the intermediary years, we have used interpolated values, assuming constant growth across each decade.

²² Belgium is the only country with regionally differentiated waste scenarios.

²³ <http://www.plan.be/Desc.php?lang=en&TM=46&IS=57>

²⁴ <http://www.plan.be/Desc.php?lang=en&TM=34&IS=57>

²⁵ Mazzanti and Zoboli, *Waste generation, waste disposal and policy effectiveness. Evidence on decoupling from the European Union*, Resources, Conservation and Recycling 52 (2008) 1221-1234.

²⁶ Mazzanti and Zoboli, *Municipal Waste Kuznets Curves: Evidence on Socio-Economic Drivers and Policy Effectiveness from the EU*, Environmental and Resource Economics (2009) 44:203-230

²⁷ Iafolla, Mazzanti and Nicolli, *Are You SURE You Want to Waste Policy Chances? Waste Generation, Landfill Diversion and Environmental Policy Effectiveness in the EU15*, FEEM Nota di Lavoro 77.2010.

Where C is the consumption per capita²⁸, X_i refers to a vector of other socio-economic and structural variables, and Z_i refers to a vector of policy variables. i is an index for the countries covered in the study, and t refers to time. e_{it} is an error term, and reflects mainly the influence of missing variables. The variables are usually expressed in natural logarithms. Therefore, the coefficients of the equations can be interpreted as elasticities: they give the percentage change in the dependent variable for a unit percentage change in each independent variable.

For instance, if β_1 is the elasticity of waste generation per capita with respect to consumption per capita, then: $\frac{\Delta(\text{waste per capita})}{\text{waste per capita}} = \beta_1 \frac{\Delta(C)}{C}$. For very small changes, this becomes: $\frac{d(\text{waste per capita})}{\text{waste per capita}} = \beta_1 \frac{d(C)}{C}$ or: $d(\ln(\text{waste per capita})) = \beta_1 d(\ln(C))$.

Econometric studies of this type usually encounter several types of challenges:

- Often, not all relevant explanatory variables can be included in the analysis (either because no reliable data exist, or because the available sample is too small²⁹).
- If we have several countries, and we estimate specific coefficients for each country, we take fully into account non-observable differences between countries, but our estimates also become more sensitive to data flaws in individual countries. If we impose that all coefficients should be equal for all countries, we increase the sample size (and reduce the influence of country specific problems with the data), but we also make the implicit assumption that all countries are identical (except for the observable explanatory variables). Between these two extremes, a wide variety of “hybrid” solutions exist.

There exists a wide variety of econometric techniques to cope with these problems, and all have their advantages and drawbacks. The three papers we consider here present the results for several different approaches and data sets - we refer to them for a detailed discussion.

After extensive discussions with one of the authors of these paper³⁰, we have concluded that, both for the old and the new member states, the most robust specification is provided by the fixed effects models provided in Table 2 of Iafolla et al.

The reason we prefer this specification is that:

- For the EU15, these estimates are based on the most recent data (up to 2007).
- Mazzanti and Zoboli (2008) provide separate estimates for the EU10 (but not for Bulgaria or Romania) – see Table 2c. However, these are based upon data in the period 1995-2005. Some of the results (indicating that the NMS are close to absolute decoupling between waste generation and economic activity) are probably mainly the results of these countries’ transition to a market economy in this period. Therefore, we do not think they can be used for forecasting purposes.

²⁸ It is explained in the papers why consumption per capita is a better explanatory variable for MSW generation than GDP per capita.

²⁹ The reliability of estimates decreases when the number of explanatory variables becomes too large in relation to the sample size. Once the number of explanatory variables exceeds the sample size, it is mathematically impossible to estimate the coefficients.

³⁰ E-mail correspondence between Laurent Franckx and Massimiliano Mazzanti.

- Mazanti and Zoboli (2009) provide global estimates for the EU25 (Table 4). These results suggest that the elasticity of waste generation with respect to consumption is rather low: 0.239 or less, depending on the details of the model. Again, we conjecture that this result is affected by the transition period in the NMS.
- Iafolla et al. (2010) also provide unconstrained estimates for individual countries. However, some results (for instance, for Belgium, Denmark and France) are not statistically significant or run counter to expert opinion (for instance, pointing to absolute delinking in Greece, Portugal and Spain). We conjecture that this is due to the small number of observations per country.

For the purposes of this study, we have decided to assume an elasticity of waste generation with respect to consumption of 0.38. This is the upper bound to the estimates provided by Iafolla et al., and corresponds to a very high level of relative decoupling. However, because the term for the square of (the log of) consumption per capita was not statistically significant, we have no evidence for absolute decoupling. None of the other possible explanatory variables was found to be significant either.

Compared to the other estimates we have considered, this approach will lead to a higher forecast for MSW generation. For some countries (such as Austria and Germany) this estimate is probably too high; for others, it may be too low. However, at the aggregate level of the EU27, this is arguably the most robust estimate that can currently be found in the scientific literature.

Of course, this scientific literature also points to another important lesson: with the data that are currently available at the level of the EU, different econometric approaches can lead to quite different results. Therefore, any forecast of MSW should be interpreted with circumspection: the magnitudes offer an indication of what can be expected if all other variables except GDP remain constant, but should not be interpreted as accurate predictions.

A more general conclusion is that these papers point to the need for models that forecast waste generation based upon surveys of individual households, rather than upon macro-economic data. An extensive discussion of this issue however goes beyond the scope of this study.

4.2 SUPPORT FOR RENEWABLE ENERGY

Most biowaste treatment options allow the owner of the facility to derive some revenue from the sale of energy – the different possibilities are discussed in detail in the ARCADIS/Eunomia report.

This possibility does not only affect directly the profitability of each waste management option, but also leads to indirect environmental effects (depending on the energy source that is displaced).

Within the EU, several national support schemes for renewable energy exist. As support schemes only affect private costs and not social costs, no formal modelling of these schemes has been undertaken. However, changes in support schemes are informative because they indicate which treatment options are becoming relatively more profitable from a financial point of view.

As pointed out in the ARCADIS/Eunomia study, most schemes within the EU are based on a fixed level of price support (e.g. feed-in tariffs) or a quantity based scheme (typically coupled with tradable green certificates). It was also reported that tax reductions or exemptions are used in some Member States to incentivise renewable electricity generation.

In the ARCADIS/Eunomia study the level of support (in €/MWh) for renewable electricity are based on a DG TREN funded study on renewable energy markets³¹. In January 2011 Ecofys published a study on the financing of renewable energy in the European Energy Market.³² Herewith new renewable energy policy country profiles were prepared based on information available in October 2009³³.

The assumptions of the ARCADIS/Eunomia study are based on the 2008 country profiles. In the table in Annex D we compare the 2009 country profiles with the 2008 country profiles in order to identify any changes to support schemes related to electricity from biomass or biogas and the use of biogas from AD in vehicle applications. We can also refer to section 4.4.1, where some results of the stakeholder consultation are discussed.

We have considered that the changes we have identified were not significant enough to justify a revisions of the assumptions used in the ARCADIS/Eunomia study. Hence, the information of Annex D has not been used in the formal modeling.

4.3 COSTS OF SELECTIVE COLLECTION

The ARCADIS/Eunomia study concluded that the cost of separate bio-waste collection varies considerably according to local circumstances, noting that separate collection of bio-waste can be undertaken with no additional costs if it is optimised.

In the context of the stakeholder consultation, stakeholders were asked if they were aware of any other costs assessments referring to separate collection of bio-waste, prepared at national, regional or local level (especially conducted during the last 5 years), that had not been taken into account in the ARCADIS/Eunomia study. Please find the answers of the different stakeholders in the Annex . In general, not much new evidence that was not already cited in the ARCADIS/Eunomia study is available.

The conclusions of some additional studies identified through the stakeholder consultation can be found below.

According to these studies and the consultation of additional experts³⁴, it seems to prove true that, as already stated in the ARCADIS/Eunomia study, information on the logistical costs of separate collection cannot easily be generalised, as they depend a lot on the local context and are therefore largely variable. In France for example, several collectivities have undertaken studies on the topic with the result that for some of them separate collection is economically more interesting while for others it is less interesting as it depends on their context (territory and its density of population, capture rates and yield of biowaste, etc.).

³¹ ECOFYS, Fraunhofer ISI, EEG, Lithuanian Energy Institute and Seven (2008) Renewable Energy Country Profiles, February 2008

³² ECOFYS, Fraunhofer ISI, TU Vienna EEG, Ernst & Young (2011) Financing Renewable Energy in the European Energy Market, January 2011

³³ ECOFYS, Fraunhofer ISI, Energy Economics Group (EEG) TU Vienna, Lithuanian Energy Institute (LEI), Renewable energy country profiles, 2009 version

³⁴ Yves Coppin, VEOLIA, interview 28 February 2011. Jean-Michel Sidaine, AWIPLAN, interview 15 February 2011.

Furthermore, important bias can be introduced when trying to estimate the relative costs for separate collection versus mixed waste MBT: on the one hand, the amount of waste effectively separately collected has a strong influence on the final cost-efficiency of a separate collection system ; on the other hand, the costs of the MBT treatment can very much depend on the quantities of impurities present in the waste, especially when biomethanisation takes place. These two parameters illustrate how some key assumptions can affect the final result of the comparison.

Each cost assessment has therefore to be considered critically.

The studies cited below had different approaches. The first study observed collection costs of all biowaste (food waste and green waste) of an already established collection system in France while the

Investigation of collection costs in France

The French Environment Agency ADEME undertook a techno-economic analysis of the collection and treatment costs of bio-waste in 2006 of 17 collectivities, having implemented a collected selection of bio-waste. In 6 of them, collection takes place according to type 1 (operations targeting mainly or exclusively kitchen waste), while 11 of them belong to type 2 (operations targeting all kind of biowaste – kitchen waste, green waste...).

The sample of collectivities covered a wide range in terms of total population (4 000 to 210 000 habitants) and population density (15 to 825 habitants/km²). 2/3 of type 1 collectivities are located in rural areas while 2/3 of type 2 collectivities are located in relatively urban areas of more than 180 inhabitants per km². The frequency of door-to-door collection of residual household waste and bio-waste is mostly weekly.

The analysis of the costs of collection shows that with existing organisation and performance, the separate collection of bio-waste generates an additional cost of about 5 to 10%, ranging up to 20%, in 10 of the 17 collectivities (mostly belonging to type 2). For the remaining 7 collectivities, the costs are equivalent with and without separate collection. While the costs (treatment, transport collection etc.) of mixed waste management varied from €107 to €241 per tonne, they lay between €140 to more than €300 per tonne for separate collection.

second study, focusing exclusively on food waste, investigated the performance of a trial collection system in Scotland, discussing only in general terms costs of specific collection logistics (collection vehicles, staff, liners). The third study assesses future costs of Scotland's Zero Waste Targets under different scenarios and at which levels of separate collection these targets can be met.

Separate food waste collection in the UK

WRAP provided funding and technical support to 21 local authorities to carry out trials of separate food waste collections (assuming that garden waste can be collected and composted separately at a lower cost per tonne, i.e. in open windrows). The subsequent evaluation of the performance shows that in terms of collection costs, the choice of collection vehicles, how they are operated by crews as well as the number of staff required to carry out collections is vital in order to develop a cost efficient service. Another logistic element that can involve significant cost is the provision of liners (garbage bags) to residents, particularly if they are provided free of charge.

In addition, in the Preparatory Study on Food Waste³⁵, the selective collection of food waste as a policy option was not prioritised because its impact on waste prevention was less significant than its impact on the diversion of bio-waste from landfill, and because its implementation/logistical costs were considered high compared to other policy options. See table 3 for details on the different costs of separate collection (UK, Spain) that were taken into account in the study.

Table 4: Estimated costs of food waste separate collection

Costs of implementing separate food waste collection	
Household containers 10 litres	1 € per inhabitant
Compostable bags	0.82 € per inhabitant (for 30 units)
Communication campaign	1-5 € per inhabitant, depending on density of municipality
Collection vehicles	30, 000 € ³⁶ - 80,000 € ³⁷ per vehicle
Cost of separate collection followed by composting	35-75 €/tonne
Cost of separate collection of bio-waste followed by anaerobic digestion	80 to 125 €/tonne

Source: Eunomia, ARC Catalan Waste Agency

The cost include both implementation costs, in terms of new vehicles, new staff training, information dissemination to residents and administration costs. As stated in the Food Waste study, the costs for EU

³⁵ Preparatory Study on Food Waste across EU 27, BIO Intelligence Service for DG Environment, 2010.

³⁶ ECN/ORBIT – First Baltic Biowaste Conference 2006, presentation Enzo Favoino: “The Economics of different separate collection schemes for biowaste”.

³⁷ ARC Catalan Waste Agency – Written response to stakeholder consultation 2010.

MS may vary somewhat from those costs logged in Spain and the UK. The study points out that the actual implementation costs would however vary based on multiple factors, e.g. the level of subsidy and investment, as well as the current maturity of the waste management infrastructure in the MS.

Investigation of future collection costs in Scotland

A report published by the Scottish Government examining the costs to local authorities of meeting EC and Scottish Government Waste targets, shows that whichever strategy was chosen, the costs for waste collection authorities would significantly increase over the period to 2025 by between £1 – 1.5 billion over net present value. According to the study, taking into account only quantitative aspects, it appears though that the cost increase with greater separate collection will not be as great as with other collection strategies.

The study points however out that this conclusion is dependent on the successful implementation of separate collection (with levels of source segregation of 60% to 65%). This would require a high participation rate in food/bio-waste collection which cannot be assumed with certainty which could in turn create additional costs for e.g. education and public awareness campaigns.

4.4 EXPERIENCES WITH SELECTIVE COLLECTION AND BIOLOGICAL TREATMENT

4.4.1 NATIONAL LEGISLATION ON BIO-WASTE RECYCLING AND SEPARATE COLLECTION

The stakeholder consultation (see the Annex to this report, part 1, question 1) provides information on the policy measures and legislative practices of 9 Member States (CZ, DE, DK, ES, FR, NL, SE, SL, UK) and Norway. Further information was received on some practices and policy measures of CZ³⁸, PT³⁹, EE and SL (Barth, J., personal communication).

These data clearly demonstrate that generally, the promotion of bio-waste recycling and separate collection is receiving increased attention. Nevertheless some Member States still focus most of their efforts on diverting waste from landfill in order to meet the targets of the Landfill Directive, rather than on improving resource efficiency and material recycling. Waste management investments in these countries are mainly directed towards incineration and Mechanical Biological Treatment (MBT), as most cost-effective measures in the short term to comply with the Landfill Directive. (PT, EE)

In many of the above countries, the interesting potential of anaerobic digestion for simultaneously producing biogas and a soil additive is increasingly being recognised. Legislative practices and supporting measures are (being) developed in order to stimulate a widespread uptake of the technology. New installations are being built or planned, renewable energy schemes are adapted, feed-in tariffs established, administrative practices to allow for biogas injection into the gas grid or its use as a vehicle fuel developed, research projects carried out, etc. Some examples of administrative starting difficulties are pointed out:

- Habart & Machálková refer to some legislative issues, which delay the full development of AD in CZ. A feed-in tariff system of support is oriented towards two separate categories of AD plants: agricultural AD plants, which are not allowed to treat any waste on the one hand, and biodegradable waste AD plants on the other hand. The potential synergies between the two plant types, optimising the proximity principle, cannot be exploited. At the same time the capture of landfill gas is also being supported by means of feed-in tariffs, and landfill fees are allocated to the municipalities where the landfill is located. These factors contribute to reducing the efforts made for diverting waste from landfill.
- NO reports that industry is calling for clearer political signals and economical instruments for the biogas industry and to assist in building up the production side of biogas and the infrastructure to distribute the gas.
- Concerns are expressed over the low values of the feed-in tariffs for AD in the UK, AD operators predicting that many smaller farm-based plants would not go ahead to export the surplus electricity. This concern was confirmed by the fact that in the second quarter of 2010/11, no AD plant had joined the scheme.

As for encouraging separate collection, the measures taken differ widely between Member States.

³⁸ Habart, J. & Machálková, J. Challenges to Start Anaerobic Digestion in the New Member States. The Czech Example of Antagonistic Support. Project No. 2B08082 supported by the Ministry of Environment CZ.

³⁹ Pires, A., Silveira, A. & Martinho, M.G. (2010). MBT and Anaerobic Digestion in Portugal – A Concept to Meet EU Landfill Directive Targets. Presentation at the 8th ASA waste days, Hannover, 2010.

Different waste fractions are targeted: some Member States focus on green waste collection, others on bio-waste from commercial and industrial processes, on the total amount bio-waste generated, on vegetable, fruit and garden wastes from households (VFG-waste), on food waste from households or households, caterers and retailers or on combinations of these fractions. The main measures reported are:

- mandatory separate collection of total bio-waste or a certain bio-waste fraction, in most cases complemented by a clause allowing for exemptions in specific cases, based on the results of life cycle assessments, or imposing the obligation as long as technically, economically and environmentally feasible
- Separate collection targets expressed as a total amount to be collected by a certain date
- Recycling and/or composting targets for bio-waste including a separate collection requirement
- General (municipal) waste recycling targets, which include bio-waste recycling
- Landfill bans
- Landfill taxes
- Composting standards as well as quality assurance and control systems
- Waste Management plans supporting home composting
- The installation of networks of civil amenity sites
- Public information campaigns, advice to local authorities and research targeting (food) waste prevention or participation in separate collection
- Minimum standards, defining the minimum environmental performance for processing a specific (bio-)waste type
- Transposition of the new WFD

It is widely recognised that a mix of these instruments generally leads to the best results as regards bio-waste recycling practices.

Both landfill bans and landfill taxes are considered very effective measures to divert waste from Landfill. In most countries, bio-waste recycling targets or separate collection requirements have only recently been established. However, in Member States with a long-term experience as e.g. DE and NL they have proven to effectively stimulate recycling. Nevertheless, NL recently (2008) decided to extend the exemption criteria for mandatory bio-waste collection from households, since granting more flexibility to municipalities for adapting their waste management to locally optimised schemes was deemed necessary. The 2009 waste treatment statistics show a slight decrease in biologically treated household bio-waste, which might in part be explained by this relaxation of the separate collection requirements. On the other hand, DE decided to strengthen their recycling practices by introducing mandatory separate collection of all bio-waste, throughout DE, allowing for exemptions when environmentally and technically justified. In this way it is expected to reduce the still significant amounts of bio-waste found in municipal waste (MSW).

SE explicitly states that industry considered their food waste recycling target as a very effective driver for recycling, although it has not been fulfilled entirely yet. Hence, a new national target with a slightly different formulation is about to be proposed.

Experience from ES demonstrates the potential of separate collection targets: Catalonia is the only region where an ordinance stipulates mandatory separate collection of bio-waste in all settlements with more than 1000 inhabitants. It turns out that this is also the only region where bio-waste recycling practices are fully developed.

The national plan supporting home composting in FR is reported to become quite fruitful.

The awareness-raising campaigns on food waste prevention, behavioural studies on participation in separate collection programme, food waste trials, etc. of the Waste and Resources Action Plan (WRAP) in the UK lead to a better understanding of the optimisation of collection schemes, and have allowed to include an increasing amount of households in separate collection and recycling schemes.

4.4.2 BARRIERS AND POTENTIAL SOLUTIONS

The stakeholder consultation (see the annex to this report, part 2, question 6 and 9) points to a series of barriers which are or could be experienced when rolling out a separate collection/recycling system. Most of the problems mentioned have been raised in previous studies or bio-waste related consultations. The difficulties reported can be summarized into a few general and interrelated issues:

1) Knowledge issues

Lack of experience in and knowledge about the benefits of recycling/separate collection, the methods to set up a successful collection scheme, the cost structures, the ways to ensure compost/digestate quality, the uses of compost/digestate, the market functioning of waste-derived products such as compost, etc. This holds for citizens, as well as for the national/local competent authorities and the operators. A clear role can be identified for the EU with respect to facilitating information gathering and best-practices exchange. Several stakeholders express the need for exhaustive data collection on the advantages and disadvantages of separate collection and different bio-waste treatment systems throughout the EU in order to substantiate waste management choices.

2) The current waste management infrastructure and practices

These lead to technical issues such as the unavailability of adequate infrastructure to collect and treat the bio-waste and the need to use and fill out the free capacity of any existing infrastructure. Furthermore, long-term experiences with certain waste management or collection practices, which are felt to deal adequately with the waste produced, reduces the interest in other technologies if the benefits the latter are not clearly depicted or understood (see 1)). Additionally, problems are expected to arise with the adaptation of the existing, usually long-term, collection and waste management contracts to the new requirements. Any EU-level legislation or target setting should thus be accompanied by an adequate transitional period in order to cover these issues.

3) The associated costs

Most stakeholders point to some cost-related aspects which, especially in the current economic climate, form or are expected to form barriers to the introduction of separate collection systems and high quality recycling. It is noted that account needs to be taken of among others the costs of the collection bins, the vehicles, the transport, the investments in treatment infrastructure (cost of switch), the awareness-raising campaigns needed, the space dedicated to separate collection as well as the separation activity itself. Some of these cost-related concerns appear to be based on assumptions rather than practical experiences. Others might in part be addressed by an optimisation of the collection or tax/fee system. In fact, these concerns are in many cases also knowledge-based issues which could benefit from an EU-wide information gathering and best practices exchange.

Other financial aspects mentioned are the subsidies for other treatment methods, the fact that taxes do not reflect the external/environmental costs (e.g. low landfill fees) and contracting schemes only take account of economic criteria, the costs of the licensing requirements, the economic uncertainty of the

business and the need for financial support from the government for the introduction of new waste management systems due to the difficulties to impose the real costs to citizens.

A recent overview of current landfill taxes and bans has been provided by CEWEP⁴⁰.

This overview shows that:

- 9 MS (AU, BE, DK, FI, FR, DE, IT, NL, SV) are reported to have implemented landfill bans, but the applicability of these bans varies widely and, in some cases, does not appear to go beyond what is required anyway under the diversion targets of the Landfill Directive.
- 15 MS (AU, BE, CZ, DK, FI, FR, HU, IE, IT, LT, NL, PT, ES, SV, UK) report some sort of landfill tax/fee, but it is not clear to what extent these taxes/fees also reflect the external costs of landfilling. Moreover, the unit prices vary widely, even between countries with comparable income levels. For instance, in Austria, the average net price of landfilling lies between 60 and 130 EUR, while, in The Netherlands, it lies between 20 and 30 EUR. In some countries, the net fees also vary widely according to local circumstances.

These are all issues which need to be addressed on a political level. An effective tax and fee system, taking account of the environmental consequences of waste management activities, may provide for the availability financial resources to support environmentally preferable solutions. This is believed to be an essential prerequisite for the development of sustainable recycling practices. The economic uncertainty could be reduced by introducing a clear goal and a progressive planning system. (see also 4))

4) Political barriers

These are strongly interrelated with the above mentioned cost, knowledge and current practice related issues. The examples of lack of political ambition, the focus of the authorities on short term benefits, in view of upcoming elections, the lack of budget dedicated to awareness-raising and education, the split of waste management responsibilities between different authority levels, the uncertainty of the legislative framework which discourages investments and the lack of effective pressure to implement national waste management plans all point to the necessity of an integrated and strategic planning and monitoring system. These barriers could benefit from an EU-level guidance.

5) Logistic and social issues

It is often repeated that rolling out separate collection and recycling systems is very challenging in some areas, such as rural areas with large distances between dwellings or city centres with many high rise buildings, where participation rates tend to be low and quality issues arise. For the first category of areas, home or community composting could offer a viable solution. Participation issues have been the subject of several studies, which all point out that the type of collection systems and the collection frequencies strongly influence the yields (in amounts as well as quality) obtained. Such systems must therefore be optimised in each situation (type of bins, collection frequency, voluntary/mandatory etc.). Moreover, in some cases, fluctuations in collection frequency are needed to improve the collection results. Experience demonstrates that awareness-raising and information campaigns on the benefits of bio-waste recycling and the uses of the resulting products are of utmost importance in order to motivate householders to join in and keep on participating in the separate collection scheme. A strong interrelation with the knowledge issues (1)) and political issues (4)) is evident.

⁴⁰ <http://www.cewep.eu/information/data/landfill/index.html>

Although many stakeholders point out that separate collection and recycling has proven to be possible in all areas, it is confirmed by the examples provided and concerns expressed that in any case the best waste treatment and collection system is dependent on the local circumstances. Local flexibility is thus indispensable for any policy measure aiming at encouraging bio-waste recycling. EU-level targets focussing on the national levels are believed to maintain such flexibility at the local level.

4.4.3 EXAMPLES OF POSITIVE AND NEGATIVE EXPERIENCES

In the stakeholder consultation (see Annex A, part 2, question 8), several examples of the successful introduction of home and community composting as well as separate collection and recycling schemes are provided. These comprise examples of small villages, towns as well as large cities throughout Europe.

Besides, various examples of collection/recycling failures are reported. Most of these examples point to issues with low yields and quality of the collected materials, undermining the well-functioning of biological treatment installations. In some cases such problems are reported to have arisen despite widespread targeted information campaigns.

Other difficulties experienced concern the comingled collection of kitchen and garden waste, leading to mainly garden waste being collected and the comingled collection of green waste and paper/cardboard, causing contamination of the feedstock and carbon-nitrogen ratios, which are unsuitable for an effective composting process. One example relates the switch from food waste collection to comingled collection of food, garden and cardboard waste for reducing the associated collection costs. However, it has been argued that this might not be an effective measure for cost reduction on the longer term, since comingled collections are often found confusing, which in the end causes problems with the quality of the collected waste.

All these examples demonstrate the importance of leaving flexibility to the local level regarding the waste collection and treatment systems to use as well as the need for a thorough investigation and optimisation of the collection scheme where separate collection is introduced. Systems need to be adapted to the households' preferences as much as possible. Awareness raising and education of all people involved in waste management are key.

A specific comment refers to the findings of food waste trials, which show a clear decrease in amounts of collected food waste over time. This would be owing to the prevention effect of separate collection on the one hand and the diminishing enthusiasm of the participants on the other hand. It is regarded as a failure in terms of long-term viability of the separate collection of food waste. Again, the reported issue is believed to prove the need for continuing motivation efforts. It also points to the importance of a careful assessment and projection of the expected amounts of feedstock when determining the treatment capacities to be installed.

4.4.4 THE ADVANTAGES AND DISADVANTAGES OF BIO-WASTE TARGET SETTING

From the comments received (see the annex to the report, part 1 question 2 and part 2, question 1, 5 and 10), it appears that some misunderstandings have arisen regarding the exact scope of the proposed target. These ambiguities refer to definition of bio-waste (in- or excluding commercial or industrial waste, park and garden waste from public and commercial sources, etc.) , of recycling (in- or excluding home composting) of separate collection (comingled collections of food and garden waste allowed or not) as well as to the level of target setting (local/national). A clarification of these topics is urged for,

since different interpretations lead to numerous concerns being raised, which might not be based on true issues.

The stakeholder consultation resulted in an extensive list of advantages and disadvantages of setting EU-level targets for bio-waste recycling/separate collection. They can be summarised into a few general topics, as listed below. Again, most of the pros and cons discussed have been mentioned in previous consultations and studies.

1) Existing policy

Many of the advantages mentioned, relate to the policy gaps experienced: the Landfill Directive specifies how bio-waste should not be treated, but does not provide guidance on how it should be managed. It can easily be reached by increasing the amounts of municipal waste sent to incineration or MBT, while it is highly unlikely that these are the most environmentally sound options in all cases. Furthermore, it is limited to municipal bio-wastes. The Waste Framework Directive (WFD) specifies a preferred waste hierarchy and calls for measures to encourage separate collection, as well as environmentally sound treatment and use of the materials produced from bio-waste. However, it does not define any binding targets or measures that can easily be enforced. A clear policy goal, directing the waste management efforts towards sustainable bio-waste treatment, is believed to be lacking. Targets would provide long-term legal certainty to investors, authorities, banks and industry, which is deemed to encourage the development of an efficient bio-waste recycling infrastructure. Other EU-policies such as the Packaging Directive, the Renewable Energy Directive and the Landfill Directive are reported to clearly indicate the driving effects of target setting.

On the other hand, most opponents of EU-level targets state that the current EU legislative framework, notably the Landfill Directive, the WFD, the Renewable Energy Directive and their associated targets, already provides for sufficient drivers to promote bio-waste recycling. This is, among others, substantiated by the fact that several Member States have already managed to develop advanced bio-waste recycling practices. A better enforcement of the current legislation would therefore be preferred. It should however be noted that it is difficult to ensure a strict enforcement of broadly formulated legislative requirements such as the waste hierarchy or Art. 22 of the WFD. Examples of some less advanced Member States (see 4.4.1) show that, despite the fact that it is possible to develop high quality recycling practices for bio-waste, this does not necessarily happen everywhere. Proponents of a bio-waste target point to the potential of a bio-waste recycling/separate collection target to contribute to the achievement of existing EU-legislation such as the Landfill Directive and the WFD. A more careful examination of the best options for bio-waste management is expected, supporting a better implementation of the waste hierarchy.

Another issue pointed out is that setting a recycling/separate collection target might actually be inconsistent with Art. 4 of the WFD. Exemptions from the waste hierarchy should be allowed when justified by life-cycle thinking. It might however rightfully be argued that a recycling/separate collection target imposed at Member State level and only requiring a certain percentage of bio-waste to be recycled still leaves room for exemptions from the waste hierarchy on a case by case basis.

A further disadvantage mentioned is that consistency issues with (recently developed) national legislation might arise. It is claimed that a period of legislative certainty is needed. On the other hand, proponents state that EU bio-waste framework might actually contribute to achieving this legislative certainty.

2) Environmental effects

As far as potential environmental effects of a recycling/separate collection target are concerned, opponents argue that substantial environmental improvements are to be expected from the full implementation of the current legislation. These improvements might even be larger than the additional benefits expected from the introduction of new bio-waste targets. Furthermore LCA studies in NL have shown that none of the bio-waste options had any clear environmental advantages over the other options, with the exception of landfilling, which proved to be clearly disadvantageous. It has however been argued that the LCA framework is not the most appropriate methodology for evaluating the performance of different biological treatment methods, since it disregards some of the specific beneficial effects of compost and digestate.

As important environmental advantages of a bio-waste target setting are reported:

- The encouraging effect for Member States to take account of the full potential of bio-waste recycling. This is, not only to contribute to the reduction of greenhouse gas emissions from landfill, but also to soil protection and to saving scarce resources such as fossil fuels and nutrients (especially phosphorous). Such a target would at the same time also contribute to the achievement of other EU policy objectives than the Landfill Directive and the WFD targets, notably the Renewable Energy Directive targets, and the objectives set in the Thematic Strategy on the Sustainable Use of Natural Resources, the Thematic Strategy for Soil Protection and the European Climate Programme.
- The separate collection of bio-waste would improve the quality of other recyclable waste fractions as well as the efficiency of mixed waste incineration.

Various stakeholders however stress that, in order for biological treatment to be truly environmentally beneficial, the resulting bio-waste derived products need to be used. Therefore, a sufficient demand for these products (biogas, compost, digestate) must be present. A mix of instruments, also targeting sectors other than the waste management sector, is believed to be indispensable.

3) Flexibility

As stated before, one of the most contested aspects of a bio-waste recycling target is that it would reduce the freedom for local authorities to decide on the most optimal waste treatment methods for their specific local situation. Adaptation to local circumstances is essential for a waste management system to be effective. Proponents however argue that bio-waste treatment methods are quite flexible and adaptable to different circumstances and scales themselves. Additionally it is believed that, if an achievable target is imposed at the national level, sufficient flexibility remains at the local level. The example of NL demonstrates that a combination of a high recycling rate and a substantial amount of flexibility left to the local level is perfectly possible.

4) New technologies

Various stakeholders notice that the focus of the proposed recycling target on merely AD and composting constitutes a significant disadvantage for the development of new innovative technologies or other interesting waste treatment methods, such as pyrolysis, gasification, biorefineries in general, the biochar process, the Danish REnescience technology, wet oxidation, Auto Thermal Aerobic Digestion, Combined Heat and Aerobic Composting, etc. This remark could, among others, be addressed by specifying a separate collection target, by reformulating the target such that not the technology, but the result is specified or by leaving the technology selection to Comitology. (see also 4.4.5)

5) Balance renewable energy production versus recycling

It is remarked that diverting bio-waste from waste-to-energy plants towards material recycling technologies might conflict with local renewable energy schemes as well as with the achievement of renewable energy targets. The cement industry points out that the co-processing of bio-waste in cement plants has a substantial potential to reduce fossil fuel demand and associated greenhouse gas emissions. They fear that bio-waste recycling target setting would lead to insufficient bio-waste feedstock being available for further developing their efforts to build out an environmentally sustainable industry. On the other hand, several stakeholders argue that the low calorific value of bio-waste (with the exception of the woody fractions or fats) reduces the energy efficiency of the incineration process. Furthermore, when only considering the municipal bio-waste fraction, it is believed that this would account for a relatively small fraction of the materials for renewable energy production being lost. Since both renewable energy targets and potential recycling targets would be set at a country level and other technologies and waste fractions for renewable energy production are available, it is considered that setting a bio-waste recycling target does not preclude locally optimal renewable energy generation solutions from being found.

6) Prevention

Several respondents claim that a high recycling target could affect the efforts directed towards bio-waste prevention and home composting, thereby discouraging the promotion of the waste hierarchy. Moreover, green waste collections have been proven to shift the green waste management from the garden to centralized green waste composting. On the other hand, separate food collection trials have demonstrated a preventive effect of separate collection/recycling target. A legislative framework bio-waste recycling/separate collection target should take these issues into account. A different formulation of the targets (see further 4.4.5) or a simultaneous guideline/target addressing bio-waste prevention could constitute a possible solution. Since home composting would be included in the recycling target, this is not considered a real issue.

7) Administrative requirements

It is argued that the introduction of bio-waste recycling/separate collection targets would add a further level of complexity to the implementation of other EU-level legislations. Many stakeholders express the concern that new legislative requirements would be accompanied by an extra administrative burden. It is believed and demonstrated that the currently available data on municipal bio-waste do not allow for accurate target calculations and effective monitoring of the compliance with these targets. Several respondents state that clear recording requirements for generated and treated bio-waste streams should be laid down. Clear calculation and monitoring guidelines are also urged for. One respondent suggests to introduce a new EWC-code for separately collected bio-waste, in order to partially address these issues. Any EU-level bio-waste target should take the above concerns into account, formulating the requirements such that the additional administrative burden is minimized. The issue of administrative costs is further discussed in Section 6.2 of this report.

8) Costs

As stated before, various respondents fear that the costs of waste management would dramatically increase, due to the technology and organisational shifts as well as the administrative provisions required. Both of these issues have been discussed in previous paragraphs.

9) Other

A further potentially beneficial effect reported is the creation of jobs for low and medium-skilled workers in a regionally embedded infrastructure. This argument is further assessed in Section 6.1 of this report.

4.4.5 DIFFERENT TARGET ALTERNATIVES

The contents of this section are mainly based on part 2, question 5 of the stakeholder consultation (see the Annex to this report).

Target level

Several stakeholders suggest that the level of a bio-waste recycling target should be higher than the proposed one, or progressively increasing, in order to ensure a continuous and sufficient driver for recycling. Such a progressively increasing target could at the same time keep on encouraging Member States that already reach the 36.5 % target, while allowing for sufficient lead-in times for those Member States currently lagging behind. A few respondents are concerned that the introduction of a target lower than the current recycling practice would lead to the belief that a sufficient effort has been made, considering the enforcement of the current legislative framework less of a priority.

Target scope

Various respondents suggest that the scope of the target should be broadened. The main reasons pointed out are:

- Currently, the target does not cover the re-use of bio-waste for e.g. animal feeding. It is argued that in fact, promoting this practice would provide more benefits to the environment than bio-waste recycling. On the other hand, some stakeholders are concerned about the hygienic implications and would rather discourage bio-waste use for animal feeding purposes. It is believed that this topic needs a more thorough evaluation in order to determine the optimal practices.
- Opinions also differ on whether or not food-processing waste should be included in the target. The main reasons reported for laying down a target for bio-waste from the food processing industry are: (i) market conditions or administrative burdens might change, which could alter the currently well-established recycling practices and (ii) both separately collected municipal waste and food processing waste are usually treated by the same methods and are subject to the same objectives, so a distinction between them seems unnecessary. Inclusion in a general bio-waste recycling target instead of setting a separate target for food waste would allow for balancing the differences in garden waste produced by northern and southern Member States, while at the same time promoting synergies for co-treatment. On the other hand, this might reduce the efficacy of the target as regards municipal bio-waste recycling.

Recycling versus separate collection

The stakeholder consultation provided an extensive list of (perceived) advantages and disadvantages of formulating a potential bio-waste target as a) a recycling target, expressed as the amount of bio-waste subject to composting or anaerobic digestion and resulting in the production of quality compost/digestate or b) a separate collection target. In the light of the barriers pointed out in the preceding paragraphs, on the whole, the most important advantages of option b) as compared to the current formulation of option a) are:

- It leaves more flexibility to the Member States to choose the environmentally and economically best technological treatment option, adapted to the local circumstances,

and allows for other uses of separately collected bio-waste than AD or composting (e.g. animal feed, incineration of the woody fraction).

- It leaves room for technological innovation
- Separate collection is believed to be an important prerequisite for high quality compost/digestate, and quality is key for ensuring a well-developed compost market. (see further Section 4.5)
- The data requirements for monitoring the progress and compliance with the target would be less demanding.

On the other hand, a separate collection target is less result-oriented than a recycling target and the environmental benefits associated with bio-waste treatment are based on high quality results. Some stakeholders point out that new or future technological developments might lead to good quality results, without the need for separate collection. The fact that separate collection does not necessarily lead to recycling could also constitute a disadvantage. For making any clear statements on the preference of one option over the other, the possibility of alternative formulations for each of these targets, explicitly addressing the barriers pointed out in the preceding paragraphs, would need to be assessed (e.g. leaving room for technological development in the recycling target, etc.) Also combinations with other policy instruments might influence the relative preference of any one option over the other.

Alternative targets

Several potentially interesting alternative target (formulations) are suggested. Some of these have already been analysed in the Commission Staff Working Document accompanying the Communication on future steps in bio-waste management in the EU, but were not developed into scenarios for several reasons e.g. setting a target for the amount of bio-waste left in residual waste, introduction of a total ban on landfilling bio-waste or extension of the current limitations, setting GHG targets instead of recycling targets or differentiation according to a time schedule or obliging national target setting.

Concluding remarks

In the CBA, it is assumed that biowaste that is collected separately is recycled. Under both targets, it is assumed that additional food waste is treated by the lowest social cost treatment option (AD or IVC) for each country, while additional garden waste collected is treated in IVC. Therefore, there is a one-to-one relationship between separate collection and recycling.

The comments above identify several complications that will need to be confronted when defining targets.

One way to accommodate the concerns concerning “pure” recycling targets would be to start with a limitative list of processes that are considered “recycling”, but to require a regular revision of this list, taking into account new scientific and technological development (see for instance the discussion in section 6.4). If the legislative instrument introducing the target would describe the criteria used to assess whether a specific process can be considered as “recycling”, the revision of the list could be made subject to a comitology procedure. This would leave room for innovation.

Alternatively, defining the targets in terms of separate collection without imposing a specific recycling technology, would also automatically accommodate the concerns discussed in the previous paragraphs. As the ARCADIS/Eunomia study has shown, once the costs of separate collection have been incurred, even the private benefits of biowaste recycling exceed the private costs. Therefore, the risk that separately collected biowaste still ends up in landfills, incinerators or MBT facilities seems limited. Separate collection targets would thus provide stronger incentives for innovation.

One drawback of “separate collection” targets is that some future technologies may no longer require separate collection. If this would be the case, then separate collection targets may result in excessive costs. Again, a way to accommodate this possibility, is to introduce a revision clause in the legislative instrument, or to delegate these matters to a comitology procedure.

A second issue is that some stakeholders have argued in favour of including bio-waste from the food processing industry in a recycling target. However, as has been argued in the ARCADIS/Eunomia study, recycling targets for industrial waste could be set much higher than for municipal waste. Setting a collective target for municipal and industrial waste would not accommodate the important differences between the two categories of waste streams. Moreover, the ARCADIS/Eunomia study had also revealed that the data gaps in the field of industrial waste are even more important than in the field of municipal waste.

4.5 MARKETS FOR COMPOST

The focus is on the following elements:

- How do transportation costs affect the potential uses for compost (both within a country and internationally)?
- How does the competition with manure as a fertiliser affect the market potential for compost within a country?
- To what extent do local soil conditions affect the market for compost?
- How do concerns with respect to the quality of the compost affect its potential uses?

4.5.1 GENERALITIES

This section is mainly based on part 2, question 7 of the stakeholder consultation (see the Annex to the report).

1) Transportation costs

Several stakeholders notice that distance issues should be seen in perspective: composting and digestion plants are normally situated outside city centres with arable land within a reasonable distance. Hence, it is argued that a local market is present nearly everywhere, besides a few areas in Europe with high density of livestock inducing competition with manure (see further). Even in urban areas compost can be used for e.g. hobby gardening and landscaping. Examples provided by different respondents substantiate this statement. Different compost grades have a different market value and it is claimed that for high quality composts even transportation over large distances may still be viable. An example is provided on the importation of some German high quality composts in FR. Furthermore it is noted that synergies created with large producers (restaurants, farmers) can contribute to reducing transportation distances/costs and increasing acceptability, which could stimulate local market development.

Three examples of transportation issues are provided:

- In SE transportation cost for digestate are reported to be a major problem, due to the high moisture content of the product. Dewatering technologies and the installation of digestate transporting pipelines to arable land are expected to constitute a possible solution.

- A bad location planning of compost plants in some municipalities in ES and IT caused plants to be installed at a distance exceeding 150 km.
- In NO difficulties are experienced in finding outlets for compost/digestate. New biogas plants are reported to take this issue into consideration when locating their businesses, making early agreements with farmers for digestate use.

On the whole, it is believed that a well-considered planning and market prospection before building the composting/AD plants, as well as an elaborated marketing strategy, could help to overcome most of the transport issues encountered.

2) Competition with manure

Only two examples on market failures due to competition with manure were provided: one relating to past experiences in NL and the other one to a specific region in DK. In both cases solutions were found in outlets outside the agricultural sector.

Furthermore, a number of respondents emphasise that the manure issues are actually based on a misunderstanding: composts are soil improvers and rarely contain sufficient nutrients to be classified as a fertiliser. In many cases composts and fertilisers/manure are complementary.

3) Local soil conditions

Only one comment was provided on the effect of local soil conditions on the compost markets: Nitrate Vulnerable Zones are expected to reduce the opportunities for compost usage.

4) Compost quality

Several examples of compost quality issues were reported, all substantiating the statement that ensuring a high compost quality is essential for increasing user confidence and developing a stable compost market. If compost quality cannot be assured, the reported main uses are landfill cover or landscaping.

5) Other

Various other factors contributing to compost market failures are described, the most important ones being:

- competition with other biodegradable waste derived materials, notably sewage sludge, paper sludge waste, shredded green 'waste' and compost-like outputs of MBT.
- the belief that the market will establish itself. As for all new products, market development is believed to be indispensable.
- the stipulations Council Regulation EC 834/2007 on Organic Production and Labelling of Organic Products which prohibit the use of digested slaughterhouse waste in organic farming.
- barriers from food assurance schemes, e.g. Quality Meat Scotland, on the use of bio-waste derived products on agricultural lands.
- the low prices of chemical fertilisers (see further)
- lack of knowledge and experience of operators as well as potential clients

4.5.2 COMPOST STANDARDS

The compost standards in different countries usually list materials which are either explicitly excluded or included within the scheme. A number of countries already exclude mixed waste compost from their schemes. They would therefore be unaffected by a standard excluding mixed waste from the scope of standards. Among the countries which have standards but do not currently exclude mixed waste from

the scope of their compost standards, only Spain and France currently produce significant quantities of biowaste treatment products.⁴¹

When comparing the “strictness” of different composting standards, it has to be noted that methods for analysing the quality of compost are not harmonised in Europe, leading to different results depending on the method used. This is true for metals but even more for impurities. Hence, a standard can be considered less strict or more strict than another one according to the method used in a specific country. This fact was illustrated by a test performed with a sample of French compost (MTB), divided into 6 parts which were analysed in different countries (DE, IT, NL, BE, UK, E). It gave very different results, ranging from “being compliant” (in DE) to “not compliant” with the country specific standards.

In order to illustrate the possible impact of a common standard on compost to fulfill EoW criteria on a national standard, we observe the case of France.

In France, the product quality requirements for compost produced from MSW are defined by the French standard NF U44-051. This standard has been made statutory by the French government. The standard includes thresholds for concentrations of heavy metals and some organic compounds as well as microbiological and agronomic parameters. Compost that complies with the requirements of the standard is considered a product (and not a waste).⁴²

France has a long tradition of mixed waste composting (for waste from households). Green wastes are however already separately collected. In 2012, a mandatory separate collection and treatment for industrial and business biowaste from “large producers” (producing more than 2.5 tons of biowaste per year) will enter into force.

France has several particularities: a) waste fees are not paid according to waste quantities produced (but to the space of the housing/flat) and thus have few incentives to reduce waste generation, b) France counts 39 mixed waste composting plants and 2 AD plants (with 1.1 mio t capacity)⁴³ which would need to be modified if separate collection was to be imposed, c) there is an accepted tradition of mixed waste composting and mixed waste compost use by farmers.⁴⁴

The setting of a common standard on compost to fulfill EoW criteria would have an implication on agricultural business, as France is an important exporter of agricultural products and that traceability of these products (and of the compost used to grow them) might be required.

What is seen as the main hindering element to separate collection in France is the above-mentioned non-existence of an economic incentive, especially compared to Germany’s fee system.

The French standard NF U44-051 is however not considered as a hindrance to selected collection. Many collectivities are choosing MBT because of diverse criteria taken into account when taking their decision (price of separate collection etc.), the standard does not seem to be the decisive criterion and can therefore not be seen as a blocking element to separate collection.

⁴¹ Assessment of the options to improve the management of bio-waste in the European Union, Eunomia/ARCADIS for DG Environment, 2010.

⁴² Technical report for End-of-waste criteria on Biodegradable waste subject to biological treatment, First Working Document, JRC, IPTS, February 2011.

⁴³ Waste Management in France, Presentation held by FNADE, June 2009.

⁴⁴ Joseph Barth, ECN, Interview, 2 February 2010.

If a common standard to fulfill EoW criteria would be considered stricter than the French standard, the result would be that French compost would not be able to be sold outside of France. This situation could destabilise the French market by offering less possibilities for selling compost throughout Europe. On the other hand, some of the French farmers, even if traditionally used to mixed waste compost as stated above, could be rather reticent towards mixed waste compost and would then maybe favour imported compost from countries where the common standard (on compost from separately collected waste) applies. To what extent this choice could be made by French farmers would be determined by the relative prices of compost, and the acceptability of the French standard. Setting a stricter standard at the European level would send a strong signal that the French standard is not sufficient to ensure the (environmental) quality of the compost, and possibly affect the confidence French farmers have in mixed waste compost. Moreover, the setting of a stricter common standard on compost would have an implication on agricultural business, as France is an important exporter of agricultural products and that traceability of these products (and of the compost used to grow them) might be required.

JRC is currently working on end-of-waste criteria for bio-waste. A first working document⁴⁵ has been prepared as input to the first expert workshop on biodegradable waste subject to biological treatment to be held on 2 March 2011. The working document lists possible end-of-waste criteria (with their respective suggested values) divided into product requirements, requirements on input materials, on treatment processes and techniques, on the provision of information and on quality insurance procedures. They are still to be discussed (technical working group, expert workshop) and refined. As soon as the end-of-waste criteria will have been established, the impacts at national level could be described.

The JRC report⁴⁶ also points to some market barriers that follow from the existence of different compost standards. For instance, Dutch exports to Germany require the participation of Dutch composting plants in the German compost quality certification scheme and bilateral agreement with German Länder Governments. The JRC report also points out that Belgian exports to France need to demonstrate both compliance with the Belgian VLACO standard and the French NFU 44051 standard (analysis and certification by French labs). It is expected that export possibilities could more easily be developed with European end-of-waste criteria.

4.5.3 PRICES FOR FERTILISERS

The stakeholder consultation had indicated low prices for mineral fertilisers as a barrier to the development of markets for compost. This thesis seems however to be invalidated by events in recent years.

The FAO already indicated in 2008⁴⁷ that high commodity prices over the past years led to increased production and correspondingly greater fertilizer consumption. This was reflected in tight markets and higher fertiliser prices. This price surge starting at the end of 2007 and peaking at the end of 2008-is

⁴⁵ Technical report for End-of-waste criteria on Biodegradable waste subject to biological treatment, First Working Document, JRC, IPTS, February 2011.

⁴⁶ JRC, IPTS (2008), END OF WASTE CRITERIA, Final Report.

⁴⁷ FAO, Current world fertilizer trends and outlook to 2011/12, Rome 2008
<http://ftp.fao.org/agl/agll/docs/cwfto11.pdf>

reflected in the Eurostat data on prices of the means of agricultural production depicted in the figure below. The latest price data from Eurostat dates from the third quarter of 2010.

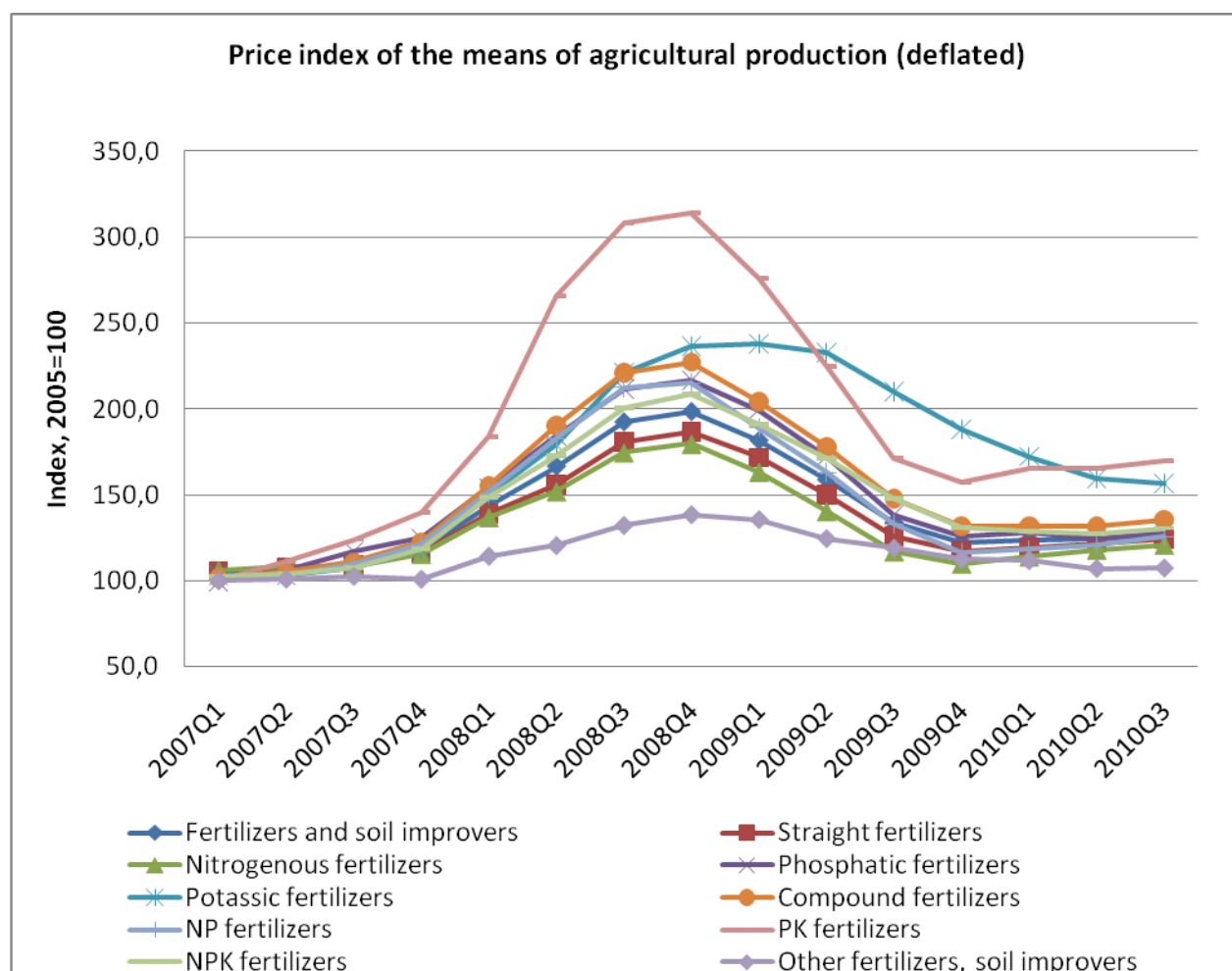


Figure 1: Fertilizer price index (Eurostat update 27/01/2011)

The commodity price data (pink sheet) from the World Bank provides fertiliser prices from 2008 to January 2010. This shows that since the third quarter of 2010 fertiliser prices have again risen sharply, with about 20% on average. The prices are however still well below the average price of 2008.

Table 5: Fertilizer price data (World Bank Pink sheet February 2011)

Commodity	Unit	Annual averages				Quarterly averages					Monthly averages		
		Jan-Dec 2008	Jan-Dec 2009	Jan-Dec 2010	Jan-Jan 2011	Oct-Dec 2009	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Nov 2010	Dec 2010	Jan 2011
Fertilizers													
DAP	\$/mt	967,2	323,1	500,7	595,8	316,9	464,8	458,2	494,1	585,6	588,0	593,9	595,8
Phosphate rock	\$/mt	345,6	121,7	123,0	155,0	90,0	102,1	125,0	125,0	140,0	140,0	140,0	155,0
Potassium chloride	\$/mt	570,1	630,4	331,9	367,5	423,0	334,0	316,1	334,2	343,2	340,6	354,0	367,5
TSP	\$/mt	879,4	257,4	381,9	475,0	235,7	316,9	357,4	389,6	463,8	463,8	472,5	475,0
Urea	\$/mt	492,7	249,6	288,6	374,1	248,3	281,0	237,2	279,2	357,0	366,4	375,1	374,1

Prices will continue to be influenced by general fluctuations in commodity prices. Furthermore demand for basic food crops, for high value crops such as food and vegetables, for animal products and for crops capable of being used to produce bio-fuels is likely to continue growing⁴⁸ as population keeps expanding and economies in developing countries are improving.

On the supply side some other evolutions can be observed:

China accounts for almost one-third of the world's production of phosphate rock, an essential ingredient of ammonium phosphate used in mineral fertilisers. In December 2010 the export duty on ammonium phosphate was raised from less than 10 % to 110⁴⁹ %. This indicates that fertilizer ingredients are becoming a strategic mineral and China likely intends to secure fertilizers for long term domestic use. This will put upward pressures on world prices.

The prices of fertilisers also follow closely the prices for energy, and can thus be expected to increase further in the near future⁵⁰.

Another source^{51,52} warns for long term scarcity in mined phosphate rock on which modern agriculture is dependent which will result in a 'peak' (cf. Peak oil) around 2033. After this point, the quality of remaining phosphate rock reserves will become lower and harder to access, making them uneconomical to mine and process. Therefore while demand continues to increase, supply decreases year upon year. The authors urge to make use of opportunities, such as the recycling of biowaste, to recover used phosphorus throughout the food production and consumption chain. However, this claim is disputed by other sources⁵³. The long term perspectives remain thus very uncertain.

4.5.4 CONCLUSION

A few years ago, some of the current study team had already analysed market failures in recycling markets for some waste streams, including food waste⁵⁴. It is worthwhile to reproduce here some of the key conclusions we had then reached with respect to the recycling markets for food waste:

⁴⁸ FAO 2008 and <http://www.istockanalyst.com/article/viewiStockNews/articleid/4839908>

⁴⁹ <http://marker-i.com/indexe.php?r=1&rd=20>, consulted on March 1 2011

⁵⁰ See The Economist, February 2011, A special report on feeding the world, <http://www.economist.com/node/18200678>

⁵¹ <http://www.soilassociation.org/LinkClick.aspx?fileticket=eeGPQJORrkW%3D&tabid=57>

⁵² Dana Cordell, Jan-Olof Drangert, Stuart White (2009), The story of phosphorus: Global food security and food for thought, *Global Environmental Change*, 19 (2009) 292-305 [Link science direct](#)

⁵³ See for instance:

http://www.ifdc.org/Media_Info/Press_Releases/September_2010/IFDC_Report_Indicates_Adequate_P_hosphorus_Resource , http://minerals.usgs.gov/minerals/pubs/commodity/phosphate_rock/mcs-2011-phosp.pdf

⁵⁴ ARCADIS Belgium and Eunomia Research & Consulting (2008), "Optimising markets for recycling". Study for the European Commission, DG ENV.

Although recent research has concluded that the market potential in Europe is twice the size of the maximum production potential, 95% of the composting plants depend on the gate fee to make a profit. This shows that the demand for compost is currently too low to cover the costs of production.

Although the factors affecting demand and supply can vary significantly between countries, one common factor across countries is that the main motivation behind their policies is to comply with the Landfill Directive by reducing the amounts of biodegradable waste going to landfill. Therefore, compost policy is mainly supply-driven and measures that could contribute to the further development of the market potential are not a priority. This leads to the paradoxical situation that even where the level of recycling is high, the actual use of the recycled product remains limited.

At the supply side, the low quality of compost in some countries has been identified as the main obstacle to further market development. Mixed waste compost is generally of low quality and is mainly used in relatively low-end applications such as agriculture⁵⁵, land restoration and landfill covers.

Selective collection of biodegradable waste has led to mixed results but has performed quite well in some cases. (...).

However, most problems in the market for compost occur downstream of collection.

A prominent issue here is clearly the distrust of potential end users with respect to the quality of compost – we have here a typical example of asymmetric information as a market failure.

The existence of credible systems of quality assurance and certification is crucial in order to overcome these problems. Some countries have now established such systems, but others have a long way to go. Moreover, a credible system of quality control is probably just a necessary condition for creating a viable market for compost. (...)

Inasmuch as selective collection of biodegradable waste could contribute to a better quality of biodegradable waste, it would lead to better market prospects for compost. However, not everyone shares this view - some favour the development of mechanical sorting followed by biogas recovery.

We think that these conclusions have been confirmed by the data collected in the context of the current study.

4.6 INCINERATION

The information received from the stakeholder consultation (see the Annex to this report, part 1, question 5) does not allow for a detailed assessment of incineration capacities across the EU, their age structure and potentially alternative sources of waste. Some, mostly very general, data are provided on the incineration plants of 6 Member States (DE, ES, NL, FR, SE, UK).

⁵⁵ “Relatively low-end” in this context means, compared to applications such as horticulture. See task 2 in the Barth et al. (2008) report for more details (footnote added).

From these data it can be concluded - with caution - that on the whole, the problems to be expected from the diversion of MSW bio-waste from incineration are quite limited. Several Member states have reduced or tied down the expansion of their incineration capacity and the amount of recently built incineration plants appears to be relatively low. It is however noted that many plants have also made investments during their lifetime, among others for installing modernized flue gas cleaning equipment or improving heat recovery. These investments need to be taken into account in order to determine whether or not costs are indeed sunk.

Furthermore, it is claimed that other industries, which in the past have invested in specific routes for bio-waste treatment e.g. as a secondary fuel, might be penalised as well. Any effects of potential targets on these businesses should thus likewise be assessed.

SE indicates that the main issue in their case is not filling up the excess capacity of the incinerators, but finding alternative fuels for the district heating system.

Potential alternative fuels reported include non-waste bio-fuels such as straw or imported waste.

CEWEP (The Confederation of European Waste-to-Energy plants) notes that experience in e.g. AT, BE, DE, NL shows that high quality recycling goes hand in hand with waste-to-energy incineration, the latter covering the remaining part, which is not clean enough for the recycling activities. In addition it is once more stressed that, with the exception of woody fractions and fats, the lower energy efficiency of bio-waste for incineration actually promotes bio-waste recycling.

On the other hand, during the workshop, several stakeholders mentioned that in various Member States and regions the current investments in waste treatment installations do not take account of any potential future EU policy focus on recycling. Incineration and MBT plants are being and will be established in order to meet the Landfill Directive targets. This is believed to complicate the development of bio-waste recycling initiatives in the near future. GAIA provides several examples of locations throughout the EU where they reckon that recent and planned investments in incineration plants create an incineration overcapacity, at the expense of (future) bio-waste recycling activities⁵⁶.

4.7 COMPLIANCE WITH THE LANDFILL DIRECTIVE

Information obtained from the stakeholder consultation does not suffice for detailed assessments to be made regarding the compliance of Member States with the Landfill Directive. Several stakeholders mention that in fact, there are no country-specific factors which could prevent Member States from bio-waste recycling and meeting the Landfill Directive targets.

4.8 SUMMARY AT THE EU27 LEVEL

We have constructed new baseline scenarios for the EU27, based upon the findings of Section 4.1 only - we discuss below to what extent the other factors discussed in this chapter are likely to affect these results.

⁵⁶ Simon, J.M. (2011). Evidence on why Europe needs biowaste separate collection targets. Available at: <http://www.no-burn.org/downloads/The%20Urgent%20Need%20for%20EU%20Biowaste%20Targets.pdf>

Table 6 provides an overview of the new projection of biowaste at the EU27, and the corresponding waste treatment methods.

Table 6: Updated baseline scenario at the EU27 level (ktonnes)

Year	landfill	incineration D10	incineration R01	MBT	composting	backyard composting	anaerobic digestion	total biowaste collected
2013	21.192	714	14.115	16.559	26.558	4.431	5.122	88.692
2014	20.296	721	14.219	17.504	27.101	4.611	5.663	90.116
2015	19.511	728	14.610	17.781	27.742	4.810	6.136	91.319
2016	17.588	735	14.750	19.134	28.400	5.067	6.628	92.301
2017	16.971	0	15.785	19.160	29.004	5.228	7.141	93.288
2018	16.548	0	15.861	19.218	29.641	5.399	7.620	94.286
2019	15.812	0	16.233	19.243	30.304	5.574	8.128	95.294
2020	14.666	0	16.341	20.244	30.872	5.685	8.503	96.311
Total	142.586	2.899	121.914	148.843	229.620	40.805	54.941	741.607

Table 7: ARCADIS/Eunomia baseline scenario at the EU27 level (ktonnes)

	landfill	incineration	MBT	composting	backyard composting	anaerobic digestion	total biowaste collected
2013	24.347	20.513	19.652	22.124	1.047	4.073	91.755
2014	22.832	20.765	20.778	22.909	1.120	4.457	92.861
2015	21.636	21.401	20.937	23.674	1.198	4.857	93.703
2016	19.247	21.631	22.445	24.430	1.278	5.272	94.304
2017	18.440	22.030	22.198	25.169	1.355	5.704	94.896
2018	17.837	22.033	22.114	25.962	1.440	6.103	95.489
2019	16.651	22.584	21.989	26.749	1.531	6.520	96.024
2020	15.122	22.553	22.772	27.600	1.627	6.885	96.558
Total	156.111	173.510	172.885	198.617	10.595	43.873	755.591

Compared to the baseline scenario that was presented in the ARCADIS/Eunomia study (Table 7), the following differences are noteworthy:

- In the ARCADIS/Eunomia study, total bio-waste generation between 2013 and 2020 was projected to be 755.591 ktonnes. The current projection thus involves a decrease of 1.85% compared to the previous scenario. This small change reflects, on the one hand, significantly worse macro-economic prospects for the forecast period, and, on the other hand, a new approach to modelling the relationship between economic activity and waste generation.
- However, for some individual treatment methods, the differences between the two models are very important. This is particularly the case for home composting, where there is a fourfold increase in projected quantities. These differences reflect the new information that was provided in the stakeholder consultation (more specifically concerning the situation in Finland, France and Italy) but do not result from any fundamental change in waste management approaches since the previous report was published. It is our conjecture that, in most member states, the actual amounts of

biowaste that are composted at home are still significantly higher than projected here, but are simply not reported.

- Compared to the ARCADIS/Eunomia study, there is a very pronounced decrease in the amounts that are incinerated (28%).
- Despite the reduction in waste generation, we observe a 28% increase in the quantities of biowaste that are recycled (home composting included). This reflects again the new information that was provided during the stakeholder consultation.

Globally speaking, we have thus a baseline scenario that is much more favourable than in the ARCADIS/Eunomia study, both in terms of waste quantities generated and in terms of the way they are treated.

The significant changes in the projections for some specific waste treatment options confirm an important point that was already made repeatedly in the ARCADIS/Eunomia report: in the absence of standardised reporting requirements at the EU level, estimates of the total mass flows treated with a specific waste treatment technology remain very uncertain. However, as we shall see in Chapter 5 the estimates of these mass flows can significantly affect the benefits of the policy scenarios.

Several factors discussed in this chapter have not been integrated quantitatively in these baselines:

- Insofar as support schemes for renewable energy have been modified, they imply a reinforcement of the support for renewable energy from biowaste. This factor is likely to lead to a higher share of AD and high-efficiency CHP than what we have assumed in the baseline.
- The new data collection has not led to a fundamental revision of the two basic premises in the ARCADIS/Eunomia study: the logistical costs of separate collection depend to a large extent on local circumstances and need not be large if the collection system is optimised.
- The support schemes for AD are likely to lead to a higher share of AD than what we have assumed in the baseline.
- Recently established bio-waste recycling targets and separate collection requirements are likely to lead to a higher share of biological treatments than assumed in the baseline (insofar as they are not yet reflected in the baseline).
- In the absence of any hard evidence that some individual MS will not meet the diversion targets of the Landfill Directive, we have assumed they all would meet these targets.

The next issue we address here is how changes in the recycling targets will translate in changes in the quantities that will effectively be recycled. This relationship can be expected to be non-linear. Suppose indeed that the recycling target is α % of biowaste. For countries that already reach this target, the imposition of a European target will not change anything compared to the baseline. Therefore, if we start from a planned recycling target of α %, then:

- If the planned recycling target increases to $\alpha + \Delta\alpha$ %, the effect will be two-fold: (a) the countries that do not meet the α % target in the baseline will have to increase their recycling rates further to $\alpha + \Delta\alpha$ % (b) the countries that meet the α % target in the baseline but not the $\alpha + \Delta\alpha$ % target, will now also have to increase their recycling rates (whilst these recycling rates remained unchanged under the α % target). For the countries that recycle more than $\alpha + \Delta\alpha$ % in the baseline, nothing changes between the two targets.
- If the planned recycling target decreases to $\alpha - \Delta\alpha$ %, the effect will be two-fold: (a) the countries that do not meet the $\alpha - \Delta\alpha$ % target in the baseline will have to increase their recycling rates from the baseline rates to $\alpha - \Delta\alpha$ % (b) the countries that meet the $\alpha - \Delta\alpha$ % target in the baseline but not the α % target, can keep their recycling rates at the baseline level. For the countries that recycle more than α % in the baseline, nothing changes between the two targets.

This is illustrated in Table 8, which can be interpreted as follows:

- For each MS, we have reported the total biowaste generated and recycled in 2020 according to the baseline. We have also reported the recycling rate in 2020 and have ordered the countries in descending order of recycling rate.
- Next, we have considered 8 different possible recycling targets, ranging from 10 to 80%.
- For each of these recycling targets and for each MS, we have calculated the amounts of biowaste that would be recycled *on top* of the amounts that are already recycled according to the baseline. We have also added the totals for the EU27.
- Based upon this, we have calculated the effective recycling rate for each recycling target. This effective recycling rate is always larger than the target, because each target is already met by some MS.

We can observe the following points:

- In the baseline scenario, 46,79% of the biowaste is recycled in 2020.
- Very low targets have a very small additional impact. For a 10% recycling target, we even see that the additional impact is zero. If the recycling target is 20%, then we see that the target “bites” for just 9 MS, representing 13 million tonnes of biowaste (out of 96 million at the EU27 level). The total recycling rate is 47,47%, which is a very small increase compared to the baseline. A 30% recycling rate would “bite” for 10 MS, representing 26 million tonnes. The total recycling rate would be 50,18%.
- It is only when the target exceeds the 35% that it would bite for the majority of the MS. For a 40 and 50 % recycling target, the effective EU27 recycling rate would be 53,29% and 57,98%, respectively.
- For the target above the 60%, less than 7 MS perform better than the target in the baseline. Thus, once the target exceed the 60%, the difference between the target and the effective recycling rate becomes very small.

Of course, in itself, these figures do not tell much about the actual net benefits of each recycling target.

However, we think it would be difficult to justify a target going below what would already be achieved by half of the MS in 2020, and would still be 10% lower than the EU average.

Therefore, we propose to maintain the “low ambition” target of the ARCADIS/Eunomia study in this study as the absolute threshold below which a target should not go – the net benefits of this target are discussed in Section 5.2.

Conversely, a target of around 75% would require almost all MS to perform better than what is expected in the baseline, and can therefore be considered to be an indication of the maximum that can effectively be achieved. This corresponds to the “high ambition” target of the ARCADIS/Eunomia study⁵⁷ (but without the prevention effects) – the net benefits of this target are discussed further in Section 5.1.

⁵⁷ To be more precise, Scenario II in the ARCADIS/Eunomia study assumes 60% food waste capture and 90% garden waste capture by 2020, Under the assumptions of this study, this corresponds to (approximately) a total recycling rate of 75% at the EU27 level.

Table 8: effect of different recycling targets of on effective EU27 recycling

Recycling target	Biowaste generated in 2020 (baseline)	Biowaste recycled in 2020 (baseline)	Recycling rate (baseline)	Increase in recycling compared to baseline (tonnes)							
				10%	20%	30%	40%	50%	60%	70%	80%
SI	322.097	289.888	90,00%	0	0	0	0	0	0	0	0
NL	3.536.334	2.652.250	75,00%	0	0	0	0	0	0	0	176.817
BE-FL	1.422.636	1.066.977	75,00%	0	0	0	0	0	0	0	71.132
DE	18.004.816	13.503.612	75,00%	0	0	0	0	0	0	0	900.241
LU	132.630	86.209	65,00%	0	0	0	0	0	0	6.631	19.894
IT	9.062.356	5.437.413	60,00%	0	0	0	0	0	0	906.236	1.812.471
BE-WL	811.733	487.040	60,00%	0	0	0	0	0	0	81.173	162.347
AT	1.729.117	1.011.534	58,50%	0	0	0	0	0	25.937	198.848	371.760
UK	13.292.522	7.310.887	55,00%	0	0	0	0	0	664.626	1.993.878	3.323.130
FI	1.027.247	513.623	50,00%	0	0	0	0	0	102.725	205.449	308.174
IE	656.640	328.320	50,00%	0	0	0	0	0	65.664	131.328	196.992
HU	1.493.456	710.885	47,60%	0	0	0	0	35.843	185.188	334.534	483.880
SE	2.195.798	878.319	40,00%	0	0	0	0	219.580	439.160	658.739	878.319
FR	12.527.517	4.885.732	39,00%	0	0	0	125.275	1.378.027	2.630.779	3.883.530	5.136.282
CZ	1.232.590	431.406	35,00%	0	0	0	61.629	184.888	308.147	431.406	554.665
DK	1.536.028	537.610	35,00%	0	0	0	76.801	230.404	384.007	537.610	691.213
LV	210.271	63.081	30,00%	0	0	0	21.027	42.054	63.081	84.108	105.136
LT	365.808	109.742	30,00%	0	0	0	36.581	73.162	109.742	146.323	182.904
SK	609.336	182.801	30,00%	0	0	0	60.934	121.867	182.801	243.734	304.668
ES	12.827.334	2.565.467	20,00%	0	0	1.282.733	2.565.467	3.848.200	5.130.934	6.413.667	7.696.400
EE	360.931	58.832	16,30%	0	13.354	49.448	85.541	121.634	157.727	193.820	229.913
BG	802.708	128.433	16,00%	0	32.108	112.379	192.650	272.921	353.191	433.462	513.733
CY	173.086	27.694	16,00%	0	6.923	24.232	41.541	58.849	76.158	93.467	110.775
MT	60.757	9.721	16,00%	0	2.430	8.506	14.582	20.657	26.733	32.809	38.884
PL	2.774.029	443.845	16,00%	0	110.961	388.364	665.767	943.170	1.220.573	1.497.976	1.775.378
PT	2.131.949	341.112	16,00%	0	85.278	298.473	511.668	724.863	938.058	1.151.253	1.364.448

RO	4.749.051	759.848	16,00%	0	189.962	664.867	1.139.772	1.614.677	2.089.582	2.564.487	3.039.393
BE-BR	230.514	34.577	15,00%	0	11.526	34.577	57.628	80.680	103.731	126.783	149.834
EL	2.031.833	203.183	10,00%	0	203.183	406.367	609.550	812.733	1.015.916	1.219.100	1.422.283
EU27	96.311.121	45.060.041	46,79%	0	655.727	3.269.946	6.266.413	10.784.209	16.274.460	23.570.353	32.021.066
Effective recycling rate				46,79%	47,47%	50,18%	53,29%	57,98%	63,68%	71,26%	80,03%
Difference with baseline recycling rate				0,00%	0,68%	3,40%	6,51%	11,20%	16,90%	24,47%	33,25%

5 CBA FOR REVISED TARGETS

5.1 CBA FOR REVISED TARGET 1

This first scenario corresponds to scenario II in the ARCADIS/Eunomia study (60% food waste capture and 90% garden waste capture by 2020), but without prevention effect. As in the ARCADIS/Eunomia study, it is assumed that additional food waste is treated by the lowest social cost treatment option for each country, while additional garden waste collected is treated in IVC.

The resulting changes in mass flows are represented in Table 9.

Table 9: changes in mass flows for target 1 (Ktonnes)

Year	landfill	incineration D10	incineration R01	MBT	Composting	backyard composting	anaerobic digestion
2013	0	0	0	0	0	0	0
2014	-992	-39	-564	-811	2.188	0	218
2015	-2.131	-78	-1.225	-1.766	4.758	0	442
2016	-2.788	-118	-1.845	-2.881	6.967	0	666
2017	-3.421	0	-2.623	-3.773	8.921	0	896
2018	-5.245	0	-4.037	-5.933	13.841	0	1.375
2019	-6.915	0	-5.634	-8.169	18.853	0	1.865
2020	-7.689	10	-7.240	-11.695	24.247	0	2.367
Total	-29.180	-225	-23.168	-35.030	79.775	0	7.828

Approximately 88 million tonnes of waste is removed from residual waste treatment facilities compared to the baseline. This is significantly less than under scenario II of the ARCADIS/Eunomia study, where 117 million tonnes of waste was removed from residual waste treatment.

This difference is due to a combination of two factors:

- The absence of a waste prevention effect
- The more favourable baseline (see Section 4.8 of this report)

By 2020, 27 million tonnes of additional annual biowaste treatment capacity will be needed at the EU27 level to accommodate this shift.

Table 10 shows the changes in (social) financial and environmental costs corresponding to target 1. We have also represented the corresponding changes in Scenario 2 in the ARCADIS/Eunomia study. We have used the same unit costs as those used in the ARCADIS/Eunomia study – see Annex C.

Compared to Scenario 2 in the ARCADIS/Eunomia study, we see a significant decrease in the benefits of the policy scenarios compared to the baseline scenario (by more than 60%). Moreover, we see an important change in the relative importance of environmental and financial benefits. In Scenario II, the

financial benefits represented almost 48% of the environmental benefits. In Target 1, the financial benefits correspond to approximately 20% of the environmental benefits.

Table 10: financial and environmental benefits for EU27 compared to baseline (million EUR)

	Target 1 of the current study	Scenario II in ARCADIS/Eunomia
Social financial benefits	479	2283
Environmental benefits	2420	4805
Total	2899	7088

These differences can be mainly understood by the lack of any prevention effect in Target 1: whenever society succeeds in reducing the generation of biowaste, this implies much more important financial savings than when waste is merely shifted from one facility to the other. The corresponding environmental benefit is relatively less important.

We can conclude that target 1 results in a net benefit of almost 3 billion EUR for the EU27 over the period 2013-2020. 80% of this benefit results from improvements in the environment.

The unit benefits of separate collection amount to approximately 33 € per ton of separately collected biowaste. However, these benefits abstract from the logistical costs of the separate collection. In most cases, these benefits compensate the possible additional costs for separated collection. For instance, in the ADEME study discussed in Section 4.3, a 5 to 10 % increase was observed on mixed waste collection costs ranging from €107 to €241 per tonne, which amounts to a net increase ranging between € 5 and €24 per tonne. Only in extreme cases (for example a 20 % increase of collection costs, also reported by ADEME) would the additional costs be higher than the benefits.

Let us now turn to a specific subcategory of environmental benefits: the savings in GHG emissions. In order to estimate these savings, we have used the average emissions factors for the EU27 implied by the ARCADIS/Eunomia study (see Annex C).

The implications of target 1 in terms of GHG emissions are summarized in Chart 1. We find that under Target 1, we achieve a reduction in GHG emissions of slightly more than 7 million tonnes of CO₂eq if we include biogenic CO₂ emissions, and of slightly more than 6 million if we exclude biogenic CO₂ emissions.

These figures cannot be compared in a meaningful way with the results obtained under scenario 2 of the ARCADIS/Eunomia study (49 million and 40 million tonnes, respectively), because, under scenario 2, the bulk of the GHG emissions savings was obtained through waste prevention.

However, we observe the following:

- If we include biogenic CO₂ emissions, then the bulk of the gross GHG savings is obtained through the reduced landfilling of biowaste (almost 11 million tonnes of CO₂eq), followed by reduced reliance on MBT (almost 7 million tonnes of CO₂eq). The reduction of GHG emissions by incinerators is significantly smaller. These savings are to a large

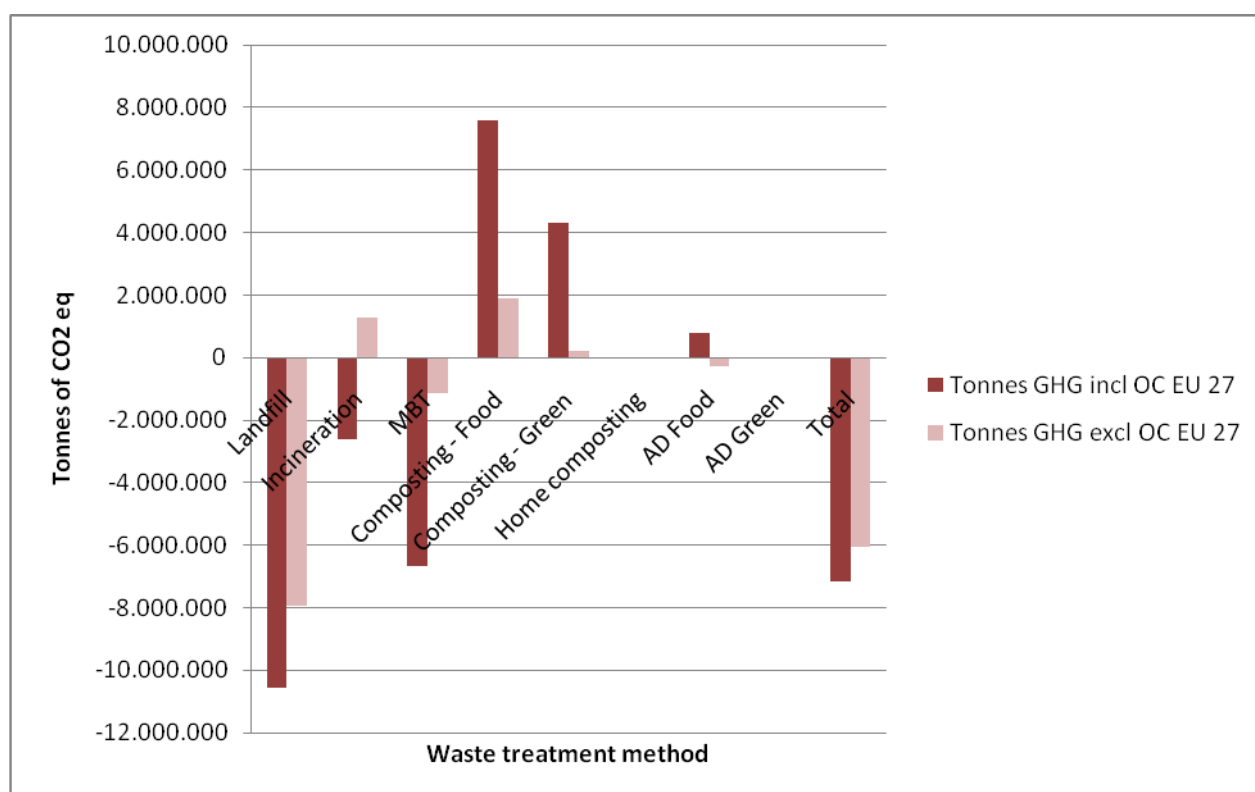
extent compensated by the GHG emissions linked to increased composting (almost 12 million tonnes of CO₂eq). AD plays a relatively minor role in the total picture.

- If we exclude biogenic CO₂ emissions, then the bulk of the gross GHG savings is still obtained through the reduced landfilling of biowaste (almost 8 million tonnes of CO₂eq). The reduction of GHG emissions by MBT installations is markedly smaller (approximately 1 million tonnes of CO₂eq) than if we include biogenic CO₂. The reduction of biowaste going to incinerators even leads to an increase in GHG emissions - the lower amounts of energy recovered from incineration processes have to be compensated (partially) by an increase in fossil fuels consumption. The gross savings are partly compensated by the GHG emissions linked to increased composting (approximately 2 million tonnes of CO₂eq). Again, AD plays a relatively minor role in the total picture.

Thus, although the total amounts of GHG savings are quite close to each other for both possible approaches, these net effects hide important differences in the gross effects. This implies that the actual differences between the two approaches could be significantly larger, depending on the actual switches between waste treatment methods that occur (for instance, under Scenario 3 in the ARCADIS/Eunomia study, there is a factor 2 difference between the two).

Using the same approach as in the ARCADIS/Eunomia study (section 11.3 of that report), it is easy to verify that the realisation of target 1 would lead to reductions in GHG emissions corresponding to less than 0.6% of the difference between the 2020 “with existing measures” projections and the 2020 targets for the EU27.

Chart 1: GHG implications of target 1



5.2 CBA FOR REVISED TARGET 2

This second scenario corresponds to scenario III in the ARCADIS/Eunomia study (36.5% separate biowaste collection by 2020). As in scenario III, there is no prevention effect. As in the ARCADIS/Eunomia study, it is assumed that additional food waste is treated by the lowest social cost treatment option for each country, while additional garden waste collected is treated in IVC.

The resulting changes in mass flows are represented in Table 11.

Table 11: changes in mass flows for target 2 (Ktonnes)

Year	landfill	incineration D10	incineration R01	MBT	Composting	backyard composting	anaerobic digestion
2013	0	0	0	0	0	0	0
2014	-353	0	-120	-425	844	0	55
2015	-601	0	-222	-751	1.469	0	105
2016	-822	0	-332	-1.109	2.112	0	151
2017	-1.055	0	-465	-1.435	2.756	0	199
2018	-1.307	0	-587	-1.791	3.437	0	249
2019	-1.497	0	-768	-2.146	4.112	0	299
2020	-1.453	0	-910	-2.812	4.825	0	350
Total	-7.089	0	-3.406	-10.469	19.556	0	1.408

Approximately 21 million tonnes of waste is removed from residual waste treatment facilities compared to the baseline – under scenario III of the ARCADIS/Eunomia study, 32 million tonnes of waste were removed from residual waste treatment.

This difference is now uniquely due to the more favourable baseline used in this report (see Section 4.8 of this report). The relative difference between target 2 and scenario III is much smaller than the relative difference between target 1 and scenario II – this confirms the important role played by prevention in scenario II.

By 2020, 5 million tonnes of additional annual biowaste treatment capacity will be needed at the EU27 level to accommodate this shift. As this is less than 20% of what was required under target 1, this confirms that the level of ambition of target 2 is much lower than the level of ambition of target 1.

Table 12 shows the changes in (social) financial and environmental costs corresponding to target 2.

Compared to Scenario III in the ARCADIS/Eunomia, we see again a significant decrease in the benefits of the policy scenarios (by more than 50%). However, the change in the relative importance of environmental and financial benefits is less pronounced than between target 1 and scenario II. In Scenario III, the financial cost savings represented almost 50% of the environmental benefits. In Target 1, the financial cost savings represent approximately 27%. These changes are only due to the differences between the baseline scenarios: the new baseline starts with higher shares of selective collection, implying that the shifts will be smaller.

Table 12: financial and environmental benefits for EU27 (million EUR)

	Target 2 of the current study	Scenario III in ARCADIS/Eunomia
Social financial benefits	141	474
Environmental benefits	527	974
Total	668	1448

Compared to target 1, we see that total cost savings under target 2 are 23%. This shows that, even in the absence of a prevention effect, the benefits of a “low” target are much lower than the net benefits of a “high” target.

We can conclude that target 2 results in a net benefit of almost 668 million EUR for the EU27 over the period 2013-2020. Almost 80% of this benefit results from improvements in the environment.

The implications of target 2 in terms of GHG emissions are summarized in Chart 2. We find that under Target 2, we achieve a reduction in GHG emissions of almost 2 million tonnes of CO₂eq if we include biogenic CO₂ emissions, and of slightly more than 1.5 million if we exclude biogenic CO₂ emissions.

Under scenario 3 of the ARCADIS/Eunomia study these savings were 4.3 million and 1.9 million tonnes. The comparison between the two is not straightforward though, because these differences are due to the combined effect of two changes in the baseline (waste generated and mass flows going to each treatment method) that cannot be disentangled.

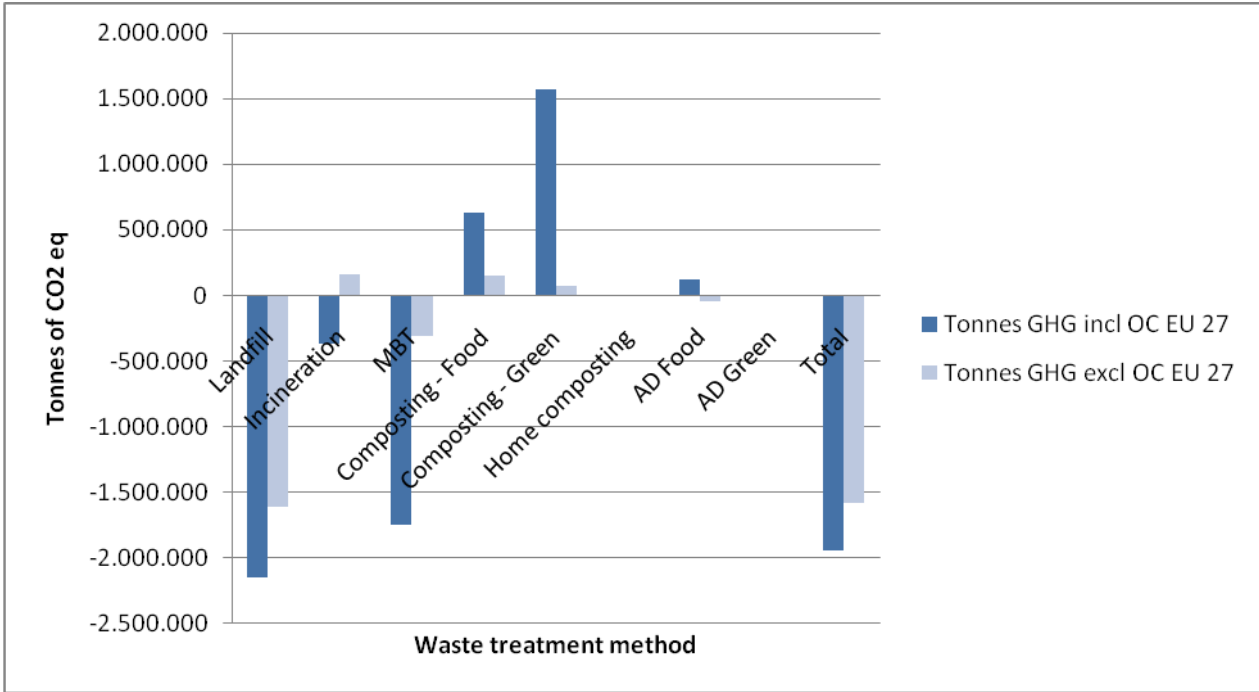
However, we observe the following:

- If we include biogenic CO₂ emissions, then the bulk of the gross GHG savings is obtained through the reduced landfilling of biowaste (more than 2 million tonnes of CO₂eq), followed by reduced reliance on MBT (almost 2 million tonnes of CO₂eq). The reduction of GHG emissions by incinerators is significantly smaller. These savings are to a large extent compensated by the GHG emissions linked to increased composting (2.2 million tonnes of CO₂eq). AD plays a relatively minor role in the total picture. In the ARCADIS/Eunomia study, the contribution of MBT to the GHG reductions was even larger than the contribution of landfill, but the general picture was qualitatively similar.
- If we exclude biogenic CO₂ emissions, then the bulk of the gross GHG savings is still obtained through the reduced landfilling of biowaste (1.6 million tonnes of CO₂eq). The reduction of GHG emissions by MBT installations is markedly smaller (approximately 0.3 million tonnes of CO₂eq) than if we include biogenic CO₂. The reduction of biowaste going to incinerators even leads to an increase in GHG emissions - the lower amounts of energy recovered from incineration processes have to be compensated (partially) by an increase in fossil fuels consumption. The gross savings are to a very small extent compensated by the GHG emissions linked to increased composting (less than 0.5 million tonnes of CO₂eq). Again, AD plays a relatively minor role in the total picture.

As under target 1, the net effects of target 2 thus hide important differences in the gross effects. This confirms that the actual differences between the two approaches could be significantly larger, depending on the actual switches between waste treatment methods that occur.

Using the same approach as in the ARCADIS/Eunomia study (section 11.3), it is easy to verify that the realisation of target 2 would lead to reductions in GHG emissions corresponding to less than 0.2% of the difference between the 2020 “with existing measures” projections and the 2020 targets for the EU27.

Chart 2: GHG implications of target 2



6 OTHER ISSUES

6.1 DISTRIBUTIONAL EFFECTS

6.1.1 LOW SKILLED WORKERS

Some stakeholders have suggested that recycling of biowaste may bring employment benefits compared to landfilling and incineration. These claims are essentially based upon the higher labour intensity of recycling activities – supposedly, expanding these activities would create more jobs than capital intensive activities such as incineration.

The analysis in the ARCADIS/Eunomia report had confirmed that a change in waste management options as described above could lead to the direct creation of a few thousands of jobs at the EU27 level in composting activities and maybe a few tens of thousands jobs in waste collection.

However, it had also been argued that this conclusion should be interpreted very cautiously, not just because it was based upon some broad generalisations, but, more fundamentally, because the higher labour intensity of a specific waste management option does not prove that a switch to this option leads to a "net" job creation in the economy as a whole.

Because, we think this issue is important and has confused the debate, we would like to repeat the argumentation in detail: somebody has to pay for a higher labour intensity, and this leads to decreased purchasing power in other fields of the economy.

There are numerous mechanisms through which these indirect effects can operate. For instance, waste management companies may charge higher prices, or municipalities may increase taxes (or reduce expenditures in other areas). If higher public expenditure is met by borrowing, interest rates will increase. If the economy is close to full employment (which is evidently not the case today, but we are analysing here a projection until 2020), a higher labour demand will lead to higher wages in all sectors, which will translate in higher prices, etc...

In other words, the employment effects described above will, to some extent, be "crowded out". This is precisely why, in a cost benefit analysis, increased employment is a cost to society, not a benefit: it takes away scarce resources (labour) from other valuable applications.

The only assumption under which the scenarios described above could lead to net job creation is if the people employed in waste management would not be competitive on the regular labour market. This would for instance be the case if these employees have been unemployed for a very long time and have lost the necessary skills and attitudes. An additional benefit of waste management activities is then that they could lead to the social re-integration of hard to employ people⁵⁸.

⁵⁸ For some recent research findings on this issue, see for instance Thomsen, Stephan L. (2009), *Explaining the employability gap of short-term and long-term unemployed persons*, KYKLOS, Vol. 62 (3): 448-478 ; Klinger, Sabine & Rothe, Thomas (2010), *The impact of labour market reforms and economic performance on the matching of short-term and long-term unemployed*, IAB Discussion Paper 201013

The question remains open how cost-effective this approach is compared to other labour market policies. Indeed, even for people with low employability, there may be an opportunity costs of employment in the waste sector, as there are other useful activities (street cleaning, to give just one example) in which they may be employed as well. We see no compelling reason why measures aiming at the re-integration of people with low employability should be linked with waste policy. Waste policy should be evaluated on its own merits.

6.1.2 IMPACTS ON HOUSEHOLDS

The implementation of selective collection depends crucially on the active collaboration of households. This has already been covered at length in the ARCADIS/Eunomia study (section 7.4.4). Let us just summarize here the issues that were considered in the study.

First, the ACADIS/Eunomia study discusses some studies that estimate the time costs for households when selective collection is introduced. The main conclusion is that, if one is considering convenient, high-quality kerbside schemes for the separate collection of biowaste, then it is likely to be a mistake to make use of estimates for time cost derived from studies focusing on less convenient bring systems or focused on dry recyclables.

Second, households may actually derive some satisfaction from participating in selective collection (“warm glow”) especially if participation is voluntarily. The net effect on household welfare is certainly difficult to assess.

Finally, a system of selective collection (again, if properly designed) may actually change norms of behaviour, in which case imputing a labour cost in the separation activity becomes especially awkward.

6.1.3 REGIONS WITH LOW POPULATION DENSITY AND URBAN AREAS

In section 4.4.2, we had already reported that several stakeholders pointed to the difficulties of rolling out separate collection and recycling systems in rural areas with large distances between dwellings or city centres with many high rise buildings, where participation rates tend to be low and quality issues arise.

For the first category of areas, home or community composting has been proposed as a possible solution. This is precisely the reason why our policy scenarios have included “home composting” as “biowaste recycling” rather than as prevention, assuming that this “home composting” is properly managed and monitored (see also the discussion in the ARCADIS/Eunomia study).

Concerning the participation issues, the stakeholder consultation has confirmed that the type of collection systems and the collection frequencies strongly influence the yields (in amounts as well as quality) obtained. Such systems must therefore be optimised in each situation (type of bins, collection frequency, voluntary/mandatory etc.). Moreover, in some cases, fluctuations in collection frequency are needed to improve the collection results. Stakeholders have also re-iterated the importance of awareness-raising and information campaigns.

and Tristan Klein & Christine le Clainche, *Do subsidized work contracts enhance capabilities of the long-term unemployed ? Evidence based on French Data*, University of Montpellier, Working Papers 08-07.

However, this study also confirms that the best waste treatment and collection system is dependent on the local circumstances. Local flexibility is thus indispensable for any policy measure aiming at encouraging bio-waste recycling.

However, there is no contradiction between EU-level targets at the *national* levels and flexibility at the local level.

How this flexibility is achieved could be left to the individual MS. Approaches could vary from a command-and-control approach where the central government assigns individual targets to each municipality (or category of municipalities) to a system of tradable targets. In a system of tradable targets, each municipality would be assigned a target, but it would be allowed to “trade” this target with other municipalities. The United Kingdom already has some experience with a Landfill Allowance Trading Scheme⁵⁹ which could provide useful lessons for countries that would create a similar system.

6.1.4 COUNTRIES WITH VERY WARM CLIMATE

The stakeholder consultation undertaken in this project has confirmed that, in warm climates, a high frequency of kitchen waste collection would be needed. However, such an increased collection frequency for kitchen waste can be compensated by a reduction in the frequency of residual and garden waste collection – see the Italian case studies discussed in Eunomia (2007) that suggest that there might be a net gain in Mediterranean countries.⁶⁰

The stakeholder consultation undertaken in this study has also revealed that, in Catalonia, 700 municipalities have introduced separate bio-waste collections, and only three have abandoned them so far. Two of these re-introduced the collection systems once they managed to overcome their problems. Several factors explain these failures, but none of them were specifically related to the climate (see the answers provided to question 8 of the stakeholder consultation in Annex A).

6.1.5 CLIMATES UNSUITABLE FOR WINDROW COMPOSTING

During the stakeholder consultation undertaken in the context of the ARCADIS/Eunomia report, it had been pointed out that the climate in Finland was not optimal for windrow composting. However, we have also been informed that home composting was very much promoted in Finland. The issues with windrow composting do not therefore not seem to be major.

6.1.6 SOIL QUALITY

The benefits of compost in terms of erosion control have been discussed extensively in the ARCADIS/Eunomia report (in particular in Annex F: Environmental assumptions, Section B.4.9.4), and we shall not repeat them here.

From the soil threat maps produced by the JRC⁶¹, we can observe that there are important regional differences in topsoil organic carbon content. All other things being equal, we would therefore expect

⁵⁹ <http://www.defra.gov.uk/Environment/waste/localauth/lats/intro.htm>

⁶⁰ Eunomia, Managing Biowastes from Households in the UK: Applying Life-cycle Thinking in the Framework of Cost-benefit Analysis, Report for WRAP, May 2007

⁶¹ <http://eusoils.jrc.ec.europa.eu/library/themes/ThreatsMaps.html>

markets for compost to develop first in those regions. However, as we will show in Section 6.1.7, in regions where there is no pressing need for the application of compost to the soil, alternative market outlet could be found. These regional differences should only constitute a problem if there exist other barriers to trade in compost, such as a lack of market confidence due to differences in standards.

6.1.7 COMPETITION WITH MANURE

Barth et al. (2008) had pointed out that, due to the huge animal husbandry in Belgium, a surplus in manure has arisen and that subsidies of up to 30 € per tonne of manure to consumers are paid. In combination with a restrictive application regulation (in order to restrict the amounts of nutrients in the soil), this makes it very difficult to sell compost to farmers⁶². However, Barth et al. also estimate that (when one includes export markets) there is enough market potential for compost in The Netherlands, which faces a very similar situation: a very densely populated country with high separate collection rates of kitchen and garden waste combined with very large excesses of animal manure on the one hand and a very restrictive nutrient/fertilising legislation on the other hand.⁶³:

The stakeholder consultation in the current project has confirmed that competition of compost with manure is an issue in some specific cases (Denmark, The Netherlands). However, alternative solutions have been found (non-agricultural markets such as hobby gardening and landscaping, export, co-digestion).

Because this issue seems to be very local in nature, export of compost to regions without excess manure production should to a large extent solve the problem. Of course, the export potential depends to a large extent on the relative values of the price for compost and transportation costs. The study by Barth et al. (2008) has already discussed this in some detail (see Task 5 – Import/Export and potentials). In the current situation, international movements are limited, but this could change with the introduction of end-of-waste standards for compost (see also Section 4.5 of the current report).

One potentially important barrier to exports would be differences in national standards, which reinforces the case for a European standard in this domain.

6.2 ADMINISTRATIVE COSTS

6.2.1 SCOPE

The scope of this chapter is to define and to quantify the administrative effort, both for authorities and for stakeholders, that are associated with the setup and the implementation of a system for separate collection of biowaste. A clear distinction needs to be made between on the one hand costs for administrative management and follow up of separate collection and on the other hand the related operational costs.

⁶² This is also discussed in the following report (in Dutch only) OVAM (2008), Afzetmarkt voor gerecycleerde materialen bevorderen. Initiatieven in de ons omringende landen. Aanbevelingen voor Vlaanderen.

⁶³ These issues are also discussed at length in JRC, IPTS (2008), END OF WASTE CRITERIA, Final Report.

6.2.2 DEFINITIONS

6.2.2.1 Separate collection

Separate collection of biowaste is defined as one or more of the following:

- A bring system at a central location where private persons can discard their garden waste;
- A bring system at a central location where private persons can discard mixed or other biowaste, including food waste;
- A bring system for occasional collection of animal waste, for instance on the occasion of the Festival of Sacrifice (Eid al-Adha: holiday for Muslims during which a sheep is ritually slaughtered). To protect animal welfare and to avoid illegal / incorrect disposal of animal waste problems, sheep cannot be slaughtered at home but have to be brought to permanent or temporary slaughterhouses. Animal waste is separated and treated / disposed of according to legal provisions, and an animal waste collection circuit for temporary slaughter places is occasionally established.
- A bring system and treatment on site in neighbourhood composting sites;
- A kerbside collection system for mixed biowaste, combining garden- and food waste;
- A kerbside collection system specific for garden waste or for vegetable-fruit-garden waste;
- Occasional neighbourhood collection of autumn leaves.

Not included are:

- Systems for support to home composting;
- The further treatment options (centralised composting, treatment, disposal) of the collected biowaste, the sale and distribution of compost etc.;
- The collection of mixed municipal waste containing a fraction of biowaste, and the subsequent treatment of the biowaste fraction of the municipal waste (like MBT, AD ... of mixed waste);
- Prevention of biowaste.

6.2.2.2 Administrative versus operational costs

Following costs are to be considered administrative costs:

For managing authorities:

- Set up of the legislative and policy framework;
- Management of subsidies for supporting separate collection;
- Administration of the public procurement for the waste collection service provider;
- Data collection and follow up for the collection scheme; development of statistics, check of targets;
- Inspection on separate collection of biowaste;
- Administration for the setup and the operation of communication and sensitisation on separate

collection of biowaste;

For implementing actors and stakeholders:

- Reporting on generated, collected quantities;
- Awareness raising on separate collection of biowaste.

Following costs are to be considered operational costs:

- Day to day management, planning, staffing and operation of collection rounds, including PAYT systems;
- Staffing and operation of centralised collection points;
- Staffing and operation of demo-sites for composting;
- Staffing and operation of quality control or certification bodies for compost;
- Staffing and operation of bodies supporting the marketing of compost;
- Inspection, quality control and management of the services provided.

It's often not easy to make a clear distinction between administrative and operational costs, because both tasks are performed by the same people in the different local and regional administrations and actors.

6.2.3 ASSESSMENT OF COSTS

Costs are retrieved from the biowaste management practice in the Flemish part of Belgium, and for extrapolation purposes expressed as full time equivalent (FTE) per # of people served.

6.2.4 SET UP OF THE LEGISLATIVE AND POLICY FRAMEWORK

OVAM, the public Flemish Waste Agency is responsible for the waste policy at a regional scale, serving 6.251.983 inhabitants. OVAM has no operational tasks itself, all its tasks are of an administrative nature. It has a staff of 352 FTE. With regard to biowaste, the following number of staff is relevant with regard to biowaste:

- 1 FTE is occupied with the follow up of EU biowaste policy
- one team of 7 FTE is engaged in the follow up of local authorities (not biowaste specific)
- one team of 7 FTE is engaged in levies and subsidies (not biowaste specific)
- one team of 7 people is engaged in management of biowaste

Tasks on separate collection of biowaste are scattered over these teams. We assume they are engaged for 10% of their time on separate collection of biowaste, which gives 2,2 FTE/6.251.983 people or ~1 FTE per 2.5 million people at the level of central administration, for Member States or policy units of about 6 million people. Larger Member States, if managed centrally, can suffice with lower FTE/capita.

6.2.5 MANAGEMENT OF SUBSIDIES SUPPORTING SEPARATE COLLECTION

The workload at the higher administrative level, within the environment agencies or ministries, is included in the figures in section 6.2.4. Frequently, local authorities or local cooperation units receive subsidies for the operation of the centralised collection or kerbside collection of biowaste. The subsidies itself are to be considered as an operational cost for the subsidising body. But the application for receiving subsidies is an administrative cost for the local authorities. The evaluation and control of application dossiers are a cost for the subsidising body.

IVAGO, the intermunicipal utility company for the city of Ghent and neighbouring municipalities, performs kerbside collection of vegetable, fruit and garden waste and the exploitation of civic amenity sites where this waste can be discarded in a bring system. It serves 255.000 people, and has a permanent staff of 350 FTE, mostly operational functions. 88 FTE have a non workman statute, and can be found in administrative and management functions. 11 FTE have an academic degree. If we assume that 10% of their time is engaged in subsidy applications of all kind, we have an administrative workload of about 1 FTE /250.000 inhabitants. In the IVAGO zone, biowaste is about 25% of both the waste collected through kerbside collection and central bring systems. We can assume that administrative workload for subsidies management can be assessed at 1 FTE/1.000.000 inhabitants.

6.2.6 ADMINISTRATION OF THE PUBLIC PROCUREMENT FOR THE WASTE COLLECTION SERVICE PROVIDER

A waste collection service provider is usually not engaged only for bio-waste collection, but for a set of waste streams that are to be source separately collected as well as for the collection of mixed municipal waste. So, it is difficult to distinguish the costs for the public procurement for the collection of biowaste separately. Compared to the administrative costs made for the general procurement of a collector, no supplementary costs need to be made for the addition of the fraction of bio-waste. Where the administrative costs will not augment, the operational costs will clearly augment for this new service to be delivered, but these costs are out of the scope of this chapter.

6.2.7 DATA COLLECTION AND FOLLOW UP FOR THE COLLECTION SCHEME; DEVELOPMENT OF STATISTICS, CHECK OF TARGETS

A policy measure like the separate collection of bio-waste requires data collection to measure the degree of success and the distance to target, and to be able to monitor and adjust the instrument. Two actors play a discernible role:

- waste collectors: collection and reporting of data;
- central authority: statistical analysis of data and drawing policy conclusions.

The waste collector, or the municipality or the group of municipalities, needs to maintain a day-to-day register on the amounts collected. We can account for 1 day per month to keep the register up to date and 1 day per year to make the report.

For the central authority we assess 1 week of work to manage the data, take care of data entry in systems, make up the statistics and analyse them.

In Flanders (6.251.983 inhabitants) 25 intermunicipal organisations are in operation (IVVO, IVOO, MIROM Roeselare, MIROM Menen, IMOG, IVIO, IVBO, Knokke Heist, IVM, IVAGO, IVLA, ILVA, VERKO,

IDM, MIWA, IBOGEM, IGEAN, IVAREM, INCOVO, HAVILAND, INTERZA, INTERRAND, ECOWERF, IOK, LIMBURG.NET). All of them organise kerbside collection, although frequency of collection and type of biowaste collected may vary.

We calculate $13 \times 25 + 5 = 330$ work days or 1,65 FTE / 6.251.983 inhabitants. This makes ~ 1 FTE per 3.800.000 inhabitants.

6.2.8 INSPECTION ON SEPARATE COLLECTION OF BIOWASTE

Inspection of separate collection as a part of the operational follow up by the municipalities is not included. We only count for the inspection efforts done by competent authorities dedicated to environmental inspection. The Flemish environmental inspection is staffed with 117 FTE. Inspections on biowaste collection are very limited, and are often incident driven or linked to waste shipment inspections. 183 inspections have been performed in 2009. If we assume that an inspection and all its overhead involves 1 day of work, and that all inspection efforts on shipment have a chance to discover and check biowaste shipments, we can count for 183 days or 0,915 FTE / 6.251.983 inhabitants or 1 FTE/6.800.000 inhabitants.

Note that these FTE are not specifically engaged for biowaste collection inspection but for inspection operations in which among other biowaste collection can be inspected.

6.2.9 ADMINISTRATION FOR THE SETUP AND THE OPERATION OF COMMUNICATION AND SENSITATION ON SEPARATE COLLECTION OF BIOWASTE

All intermunicipal organisations are engaged in sensitisation on separate collection and recycling of municipal waste. They are supported by initiatives at a higher level (the central authority) and at a lower level (municipalities).

At least 1 member of staff of the 25 intermunicipal organisations is engaged in waste sensitisation. We can assume that 10% of the tasks of the local environment official is on waste sensitisation. There are 308 municipalities in Flanders. In OVAM, the public Flemish waste agency, 10 people are engaged in sensitisation and communication.

This totals up to $25 + 30,8 + 10 = 65,8$ FTE covering municipal waste sensitisation, apart from the efforts of green dot organisations or other EPR recognised bodies that are out of scope for bio-waste. If we assume that biowaste is about 25% of both the waste collected through kerbside collection and central bring systems, we may expect a sensitisation accordingly. We assess $65,8 \times 0,25 = 16,5$ FTE / 6.251.983 inhabitants or ~ 1 FTE/ 380.000 inhabitants. This is by far the largest cost for administrative follow up of biowaste collection.

6.2.10 CONCLUSIONS

Set up of legal and policy framework	1 FTE/2.500.000 inhabitants
Management of subsidies	1 FTE/1.000.000 inhabitants
Administration of the public procurement for biowaste collection service	-

Data collection and follow up	1 FTE / 3.800.000 inhabitants
Communication and sensitisation	1 FTE/ 380.000 inhabitants

Recalculated we estimate the administrative costs for bio-waste collection at an average of 4,3 FTE per million inhabitants served.

	1 FTE per x inhabitants	1.000.000 inhabitants request x FTE
Set up of legal and policy framework	2.500.000	0,4
Management of subsidies	1.000.000	1,0
Administration of the public procurement for biowaste collection service	-	
Data collection and follow up	3.800.000	0,3
Communication and sensitisation	380.000	2,6
		4,3

The administrative cost for a Member State corresponds to the gross fee, overhead and working costs for 4,3 FTE for each million people served with biowaste collection.

6.3 COUNTRY-SPECIFIC CIRCUMSTANCES

Several possible factors that affect a country's preference for specific waste management options have already been discussed in Section 6.1 of this report. None of these factors imply that country-specific targets should be set. On the contrary: the problems related to soil erosion and to the competition of compost with manure are additional arguments in favour of a well functioning European market, which in turn requires a European compost standard in order to reduce the costs of trade.

Let us now discuss some other arguments that have been put forward in favour of differentiated targets.

First, income levels. As discussed in Section 4.1, there is no doubt that there is a link between income levels and waste generations. There is also ample evidence that income levels also affect the relative shares of landfilling, material recovery and incineration. For instance, in a classification proposed by the European Environment Agency, the "group 3" countries (with low incineration and material recovery rates) are predominantly (but not entirely) member states with lower than average incomes.⁶⁴

One plausible explanation for this relationship is that the political demand for specific waste management options depends on the country's income⁶⁵. From a short term financial point of view⁶⁶, mixed collection of waste that is subsequently disposed off in simple dump sites (or, worse, simply not collecting waste and tolerating high levels of illegal landfills), is probably the cheapest option. Due to the

⁶⁴ European Environment Agency, The road from landfilling to recycling: common destination, different routes. Brochure No 4/2007

⁶⁵ For evidence on this point, see the papers discussed under Section 4.1

⁶⁶ Poor management of landfill sites can lead to long term financial costs such as leaching and groundwater contamination, but this is not likely to materialise in the short run.

requirements of European legislation such as the Landfill Directive and the Waste Framework Directive, dump sites are no longer an option. However, in some countries, the heritage of the past weighs heavily. It is therefore not surprising that countries with limited financial resources will choose for the options that lead to compliance with the EU requirements at the lowest budgetary costs.

This is not in contradiction with the findings of the ARCADIS/Eunomia study, where it had been argued that switching to composting and/or AD would bring net financial gains:

- The ARCADIS/Eunomia study had assumed that moving waste away from landfill or incineration to compost or AD would allow to save on capital costs in landfilling and incineration. As acknowledged in the study (section 7.11.4), in the short run, capital costs are sunk, and these benefits will only materialise in the long run.
- Even if a policy option brings net financial benefits in the long run, capital costs have to be incurred up front. With imperfect access to capital markets, countries will not be able to borrow against these future financial benefits. Obviously, this argument has gained in force due to the financial crisis.

The combination of these factors (inheritance of the past and difficult access to capital markets) could explain why lower income countries will be slower to move to recycling than high income countries.⁶⁷

Whilst this does not provide an argument in favour of differentiated targets in the long run, it is clear that one possible way to accommodate this would be to introduce differentiated compliance dates, as is currently the case with the diversion targets of the Landfill Directive.

Financial support from the instruments of the EU cohesion policy could help alleviate the problems related to limited access to capital markets.

Second, environmental awareness. There is some evidence that (a) environmental awareness varies widely between the MS of the EU (b) that this awareness affects recycling.⁶⁸

It is a moot point to what extent environmental awareness is directly related to income⁶⁹. To the extent that it is, differences in environmental awareness will flatten out if incomes converge.

However, we think it is safe to assume that there is no direct causal link between the two. This raises the question to what extent differences in environmental awareness could affect biowaste policy. We can identify at least the following channels:

- Environmental awareness will affect the political demand for waste management. One might argue that, if different levels of environmental awareness result in different

⁶⁷ Even if countries would base their decisions on long term financial consideration, they will not take into account the external benefits of compost and AD to the extent that these benefits are transboundary (for instance, the impacts on greenhouse gas emissions and on transboundary air pollutants such as PM, SO₂ and NO_x). However, it is not obvious why this should be related to a country's income level.

⁶⁸ Miranda Carreño, Rubén y Blanco Suárez, Ángeles Environmental awareness and paper recycling. Cellulose Chemistry and Technology, 44 (10). pp. 431-449. ISSN 0576-9787

⁶⁹ See for instance the discussion in Chen, C. C., (2010). Spatial inequality in municipal solid waste disposal across regions in developing countries. Int. J. Environ. Sci. Tech., 7 (3), 447-456.

waste policies, then subsidiarity requires that the MS respect the preferences that are expressed at the MS level. However, this argument overlooks that some external effects of waste management (transboundary air pollution; GHG emissions; possibly groundwater contamination) have impacts beyond the individual member state. Moreover, some external impacts will only become apparent in the long run – these are coincidentally to a large extent those with a transboundary dimension. Moreover, even if these external effects would be mainly local and would already become salient in the medium term, the literature on behavioural economics emphasizes that the valuation of reductions in health and environmental risks are affected by psychological as well as physical attributes. Therefore, it is not clear to what extent the preferences of people with low levels of environmental awareness can be considered as being “well informed”.⁷⁰

- The level of environmental awareness will affect to some extent the willingness to participate in selective collection. As it would be very costly to monitor participation in such schemes, a high level of intrinsic motivation (or of peer pressure) is a prerequisite.

All in all, differences in environmental awareness do not call for differentiated targets. However, they do point to the need for extensive environmental education and awareness raising. Moreover, this is typically an area where regions and cities who would create a system of selective collection could learn from the experience of the forerunners. The Commission could play an active role in the dissemination of this experience.

Third, the availability of other renewable energy sources than biodegradable waste. In countries with relatively abundant renewable energy (such as hydropower) from other sources than biowaste, biowaste is relatively less interesting than in countries with few sources of renewable energy. The ARCADIS/Eunomia study had already taken this into account: both the financial and the environmental assumptions depend on the existing energy mix within each country and on the existing support schemes. Moreover, the ARCADIS/Eunomia study had considered country-specific uses of biowaste as a source of renewable energy.

We can conclude that the work undertaken in the ARCADIS/Eunomia study had already taken into account differences in the national endowments.

Moreover, these local influences are only important to the extent that European energy markets are not yet fully integrated and interconnected. The need for an integrated European energy network is however an issue with ramifications far beyond biowaste policy⁷¹.

Fourth, the existence of “sunk” investments in specific waste management options (such as incinerators). The ARCADIS/Eunomia study had shown that, to the extent that existing incineration capacities are indeed sunk⁷², there is a net cost to society in closing down existing incineration capacity

⁷⁰ Robinson and Hammitt (2010), Behavioral Economics and the Conduct of Benefit-Cost Analysis: Towards Principles and Standards.

⁷¹ European Commission, Energy infrastructure priorities for 2020 and beyond -A Blueprint for an integrated European energy network, COM(2010) 677 final

⁷² I.e., the investment costs cannot be recovered when one moves waste away from incineration to other waste treatment options.

to build new biowaste treatment facilities where the capital cannot be put to any useful alternative purpose. However, it had also been argued that

- The problem of switching from incineration to other treatments is only a potential problem for capacity that already exists.
- Some of the existing incinerators will be phased out of the time during which the recycling targets take effect.

It had therefore concluded that one should not be overly concerned with the implications for incineration capacity and sunk costs.

The ARCADIS/Eunomia study had also pointed out that reducing the content of food waste in residual waste will lead to *higher* average calorific values. Since most incinerators are limited by the thermal content of the waste they combust, the effect of removing greater quantities of food waste could be to reduce the overall quantity of waste which could be handled.

The stakeholder consultation undertaken in the context of the current study has revealed that none of these issues discussed above will turn out to be very relevant in practice. None of the MS that have responded to the questionnaire has expressed a concern that biowaste recycling targets may cause problems for the existing incineration capacity. Moreover, the waste-to-energy sector has argued that source separation improves the performance of incinerators, disproving the concern that removing food waste would negatively affect the amounts of waste that could be incinerated.

Sixth, the availability of outlets for compost. The availability of outlets depends on a series of factors, most of which have already been discussed elsewhere in the report:

- The existing soil quality, which affects the needs for compost (see Section 6.1.6).
- The competition with manure, especially if this leads to excessive amounts of nutrients in the soil (see Section 6.1.7).

In general, one would expect the demand for compost to be relatively low for agricultural applications in countries with good soil quality and high levels of animal husbandry. However, as already pointed out in Section 6.1.7, it would still be possible to find outlets for high grade compost outside agriculture once end-of-waste criteria have been set.

Another limiting factor that may be country-specific is that weak (or no) standards for compost quality can lead to a weak demand for compost – this may also affect the demand for compost from neighbouring countries, and can thus have a negative impact on international trade in compost. However, this is typically the type of problems that can be solved with an EU wide standard.

6.4 EMERGING TECHNOLOGIES

Some stakeholders have expressed a concern that a bio-waste recycling target focusing on composting and AD would ignore the potential benefits of other innovative ways of making use of bio-waste, such as biorefining. They have argued that recovery (rather than recycling) targets would suffer less from this disadvantage.

We will briefly discuss this issue here. Let us start with a brief description of biorefining.

The IEA Bioenergy Task 42 on Biorefineries has defined biorefining as the sustainable processing of biomass into a spectrum of bio-based products (food, feed, chemicals, materials) and bioenergy (biofuels, power and/or heat)⁷³. The biomass can be waste streams or crops.

Biorefineries show some similarities with the traditional fossil oil refineries⁷⁴: both split and separate their feedstock in different fractions and use these fractions for materials, chemicals, fuels and energy. Both strive to use all fractions of their resource without waste streams. Conventional biorefineries are the sugar industry, the production of vegetable oils, the starch industry, the pulp-and paper industry, etc. In these conventional biorefineries the focus is on the production of one main product. The new generation of biorefineries aim at valorising every side stream. Ideally, in a biorefinery chain, all components are used optimally and by-products are minimized.

An example of biorefinery of wet bio-waste streams is grass. Grass is mostly (80-90%) composed of water. The composition of the dry material is as follows: 30% fibres, 20% proteins, 25% sugars, 10% minerals and 15% other components. The pressing of the grass results in, on the one hand, fibre rich presscake and ,on the other hand, in nutrient rich press juice. The juice contains sugars and proteins that are a valuable source in other processes. The presscake can be used, for instance, as a substitute for woody fibres in the paper industry. The residues are digested, and the resulting biogas can be used in a CHP for heating and electricity- the digestate can then be applied to the land.

It is expected that this market segment will grow in the future and that this will affect the composition, the amounts and the use of different biomass waste streams.

Research on the possibilities of grass in biorefineries is ongoing, some examples are the Grassa!-project in the Netherlands⁷⁵ and Graskracht⁷⁶ in Belgium.

Amongst the preconditions (technical and non-technical) for the future growth and implementation of biorefineries, the availability of biomass streams stands out. Two specific challenges are especially important. First of all, the bio-waste streams are mostly wet streams. Second, their supply is subject to seasonal fluctuations. This means that it is difficult to store the wet bio-waste streams. Moreover, the characteristics and components are changing over time. Special measures need to be taken to preserve the bio-waste stream from degradation, such as silaging (e.g.. for grass) or simple separation techniques. It is therefore possible that recycling targets for biowaste could indeed affect the availability of feedstock for biorefining.

This then raises the question how biorefining compares to composting and AD.

Unfortunately, the current state of knowledge does not allow us to go beyond some general qualitative statements on how biorefining compares to composting and AD, both in terms of environmental impacts and in terms of costs. For instance, in terms of environmental impacts, biorefining is expected to lead to lower emissions of GHG than composting. Moreover, it would lead to a higher share of organic products.

⁷³ <http://www.ieabioenergy.com/Task.aspx?id=42>

⁷⁴ Unless stated otherwise, all material in this section comes from *Bioraffinage: Naar een optimale verwaarding van biomassa*. Bert Annevelink en Paulien Harmsen, Wageningen UR, Oktober 2010 (in Dutch only).

⁷⁵ <http://www.grassanederland.nl/>

⁷⁶ <http://www.graskracht.be/>

A drawback of biorefining compared to compost is that it would contribute less to the fight against soil degradation and to the improvement of soil quality and productivity.

Moreover, the generic terms “biorefining” refers to a wide range of very diverse processes – therefore, the comparison needs to be made on a case-by-case basis. For instance, whether separate collection is a prerequisite for biorefining depends on the details of the specific process.

Therefore, it is not possible yet to assess the impact of biowaste recycling targets (where recycling would be limited to composting and AD), neither on the performance of the biorefining industry, nor on the environment .

However, biorefining appears to satisfy the definition of “recovery” in the WFD, and some processes also satisfy to some degree the definition of recycling.

Therefore, it seems to us that the most appropriate attitude would be to adopt a flexible attitude to the processes that can be included in a biowaste target. A legislative measure in this field could start with a limitative list of processes that are considered “recycling”, but would also include a clause that requires a regular revision of this list, taking into account new scientific and technological development. If the legislative instrument would describe the criteria used to assess whether a specific process can be considered as “recycling”, the revision of the list could be made subject to a comitology procedure.

7 CONCLUSION

In this study we have verified the rationale behind the proposed targets for bio-waste recycling.

Using new data and stakeholder feedback that has become available since the finalisation of the ARCADIS/Eunomia study, we have described and analyzed the expected economic, social and environmental impacts of these targets. We have verified whether there are reasons to propose a new target or targets based on the specific situation of MS and/or subsidiarity issues.

Our conclusions can be divided in several broad categories, which we will discuss in separate sections.

7.1 CHANGES IN THE BASELINE SCENARIO

We have introduced three major changes in the baseline scenarios that were used in the ARCADIS/Eunomia study⁷⁷.

First, we have used the inputs of the stakeholder consultation and new data to improve our projections of waste treatment wherever this was possible. In total, we have modified the baseline scenarios for twelve MS.

The **second important change** is that we have used updated macro-economic and demographic forecast.

The **third important change** is that we have based our projections of MSW generation upon the most recent insights in the scientific literature. We have assumed an elasticity of waste generation with respect to consumption of 0.38, which corresponds to a very high level of relative decoupling.

The analysis in Chapter 5 has confirmed that the magnitude of the net benefits of biowaste recycling targets depends to a large extent on the baseline scenarios. However, this revision of the baseline has not led to a fundamental revision of previous study results: both targets bring net benefits at EU27 level.

7.2 THE COSTS OF SEPARATE COLLECTION

A new review of the literature has confirmed that information on logistical costs of separate collection cannot easily be generalised. However, our revised baseline scenarios do not affect the fundamental finding that, for the vast majority of estimates of the costs of separate collection, the net benefits of bio-waste recycling exceed the costs. The literature has also confirmed the need for a thorough optimisation of the collection scheme – it would certainly benefit authorities that start a new system of separate collection to learn from the experiences of others.

⁷⁷ We have also introduced some changes of purely technical nature in order to ensure that all mass flows remain non-negative whatever the values of the exogenous variables. These changes are not further discussed in this report.

7.3 THE RESULT OF THE CBA

In this report, we have considered two possible targets. No prevention is assumed to take place.

This first target required that each MS would achieve 60% food waste capture and 90% garden waste capture by 2020.

Under this target, 88 million tonnes of waste is removed from residual waste treatment facilities compared to the baseline. By 2020, 27 million tonnes of additional annual biowaste treatment capacity will be needed at the EU27 level to accommodate this shift.

This target 1 results in a net benefit (abstracting from collection costs) of almost 3 billion EUR for the EU27 over the period 2013-2020. 80% of this benefit results from improvements in the environment.

Moreover, with this target, we would achieve a reduction in GHG emissions of slightly more than 7 million tonnes of CO₂eq if we include biogenic CO₂ emissions, and of slightly more than 6 million if we exclude biogenic CO₂ emissions. These reductions in GHG emissions corresponding to less than 0.6% of the difference between the 2020 “with existing measures” projections and the 2020 targets for the EU27.

This second target corresponds to scenario III in the ARCADIS/Eunomia study (36.5% separate biowaste collection by 2020).

Under this target, 21 million tonnes of waste is removed from residual waste treatment facilities compared to the baseline. By 2020, 5 million tonnes of additional annual biowaste treatment capacity will be needed at the EU27 level to accommodate this shift. As this is less than 20% of what was required under target 1, this confirms that the level of ambition of target 2 is much lower than the level of ambition of target 1.

Target 2 results in a net benefit of almost 668 million EUR for the EU27 over the period 2013-2020. Almost 80% of this benefit results from improvements in the environment. We also find that under Target 2, we achieve a reduction in GHG emissions of almost 2 million tonnes of CO₂eq if we include biogenic CO₂ emissions, and of slightly more than 1.5 million if we exclude biogenic CO₂ emissions.

The realisation of target 2 would lead to reductions in GHG emissions corresponding to less than 0.2% of the difference between the 2020 “with existing measures” projections and the 2020 targets for the EU27.

7.4 HOW TO FORMULATE THE TARGETS

In the CBA, it is assumed that biowaste that is collected separately is recycled. Under both targets, it is assumed that additional food waste is treated by the lowest social cost treatment option (AD or IVC) for each country, while additional garden waste collected is treated in IVC. Therefore, there is a one-to-one relationship between separate collection and recycling.

In reality, several complications will need to be confronted when defining targets.

First, in case the targets are defined in terms of recycling performance (rather than in terms of separate collection), some stakeholders have argued that the definition of “biowaste recycling” should be broadened, and should include the re-use of biowaste for animal feeding. Other stakeholders have

pointed to emerging treatment options, such as biorefineries, which may well suffer from a restrictive definition of “biowaste recycling”. One way to accommodate these concerns in a recycling target would be to start with a limitative list of processes that are considered “recycling”, but would to require a regular revision of this list, taking into account new scientific and technological development. If the legislative instrument introducing the target would describe the criteria used to assess whether a specific process can be considered as “recycling”, the revision of the list could be made subject to a comitology procedure. This would leave room for innovation.

Alternatively, defining the targets in terms of separate collection without imposing a specific recycling technology, would automatically accommodate the concerns discussed in the previous paragraph. As the ARCADIS/Eunomia study has shown, once the costs of separate collection have been incurred, even the private benefits of biowaste recycling exceed the private costs. Therefore, the risk that separately collected biowaste still ends up in landfills, incinerators or MBT facilities seems limited. Separate collection targets would thus provide stronger incentives for innovation.

One drawback of “separate collection” targets is that some future technologies may no longer require separate collection. If this would be the case, then separate collection targets may result in excessive costs. Again, a way to accommodate this possibility, is to introduce a revision clause in the legislative instrument, or to delegate these matters to a comitology procedure.

A second issue which inputs should be considered in the definition of the target. Some stakeholders have argued in favour of including bio-waste from the food processing industry in a recycling target. However, as has been argued in the ARCADIS/Eunomia study, recycling targets for industrial waste could be set much higher than for municipal waste. Setting a collective target for municipal and industrial waste would not accommodate the important differences between the two categories of waste streams. Moreover, the ARCADIS/Eunomia study had also revealed that the data gaps in the field of industrial waste are even more important than in the field of municipal waste.

7.5 FLEXIBILITY

There are several factors (mostly the spatial structure) that call for flexibility in the setting of biowaste recycling targets at the local level. However, there is no contradiction between a global target at the country level and flexibility at the local level. It could be left to the MS to decide how to allocate the recycling efforts within the territory, possibly through a system of tradable permits. If home composting would be included in the targets, this could help rural areas with very low population densities – however, this then raises the specific concern of quality control.

Our analysis has also confirmed the existence of local differences in the need for compost. On the one hand, there are significant differences in soil quality (and thus in the need for compost) across the EU. On the other hand, in some regions, the high density of livestock (and, consequently, the high amounts of manure that need to be disposed off) implies that compost cannot be applied to agricultural land. However, in case no local market for compost is present, long distance transport might be viable for high grades. This confirms the importance of having high quality compost as a pre-requisite for market confidence.

There is one important factor that calls for differentiation between MS: the current state of their waste management infrastructures and policies. Maybe surprisingly, the setting of biowaste recycling targets should not cause fundamental problems for existing incineration infrastructure because, amongst other:

- The recent expansion of incineration capacity has been limited.
- Bio-waste has lower energy efficiency for incineration anyway.

The main issue is that some MS are still very much in the process of moving away from simple dump sites to sanitary landfills. However, this does not imply that the final targets should be different, but that a sufficiently long transition period should be foreseen, and that this period should be longer for countries that have a longer way to go.

7.6 THE LEVEL OF THE TARGETS

We have explained in Section 4.8 why it makes sense to maintain the targets that were considered in the ARCADIS/Eunomia study.

Indeed, any target going below the “low ambition” target would go below what would already be achieved by half of the MS in 2020, and would still be 10% lower than the EU average. Its net effect on total biowaste recycling in the EU27 would be really small. For instance, for a 30% target, total recycling would increase from 46,79% to barely 50,18%.

Conversely, a target of around 70% would require almost all MS to perform better than what is expected in the baseline, and can therefore be considered to be an indication of the maximum that can effectively be achieved. This corresponds to the “high ambition” target of the ARCADIS/Eunomia study (but without the prevention effects).

Our analysis has confirmed that the net benefits (excluding collection cost) of a “high ambition target” would be more than four times larger than the net benefits of a “low ambition target”, even though we have no longer allowed for prevention effects. Therefore, any argument that the target should be lower than the high recycling target should be based upon costs that have not been addressed in the ARCADIS/Eunomia study. To the extent that costs of recycling targets have been reported during the stakeholder consultation, it was only in qualitative terms. Moreover, some arguments mainly show that an immediate transition is not feasible. The stakeholder consultation has revealed very little concrete information⁷⁸ that these “high ambition targets” (or targets that would come close to these “high ambition targets”) would be infeasible, allowing for a long enough transition period. Therefore, both problems (the lack of concrete info and the time required to invest in alternative systems) can be tackled through the gradual approach we propose below,

Our recommendation would be therefore to proceed in two steps.

First, set a “low ambition target” for 2020 (such as “target 1” in this study). This would enable member states to concentrate on the easy-to-collect waste streams, to gain experience with biowaste management, to exchange good practices with other member states and to build up the necessary

⁷⁸ Generally speaking, the countries that have limited or no experience with the separate collection of biowaste have also provided very little information on the concrete problems they are facing (or think they will face) with the implementation of separate collection. It is thus possible that some real barriers have not been documented in this study. However, in the absence of any concrete information, a discussion of these barriers would be purely speculative. All stakeholders have received ample opportunities to document these barriers.

infrastructure. By 2020, sufficient insight should also have been gained in the properties of emerging treatment technologies (see section 6.4) to make an assessment of whether they should be considered as “recycling” technologies or not. By not setting an overly ambitious target by 2020, one could thus avoid lock-in effects.

Second, in the longer run (say 2025-2030), a more ambitious target should be aimed at, which should be set closer to “target 1” as defined in the study.

Low density areas are of course a structural issue, but that is why the Commission has proposed to include home composting in the target. The problem with home composting is supervision and quality control. If supervision would not be feasible or would be too costly, then an alternative approach would consist in allowing Member States to ask for an exemption for “isolated settlements” (for instance, such as they have been defined in Article 2 of the Landfill Directive⁷⁹) – the procedure for this exemption could then follow Article 3 of the Landfill Directive.

7.7 ROLE OF THE EU

What role could the EU play in biowaste management, independently of the issue of (recycling or collection) targets?

First, one essential prerequisite for the further development of markets for compost is increased market confidence and lower transaction costs. Therefore, there is a clear case for end-of-waste criteria and corresponding European standards for compost, whether or not recycling or collection targets would be introduced.

Second, it is clear that there is a lot of mistrust with respect to the cost of the separate collection and recycling of biowaste. We have argued that these costs need not be high if the corresponding processes are optimised. Admittedly, that’s a big “if” – the stakeholder consultation had revealed that there is an important knowledge problem at all levels (households, local authorities, national governments). Therefore, there is a strong case for the dissemination of good practices and awareness and information campaigns. This is definitely an area where the EU could play an important role, both to bring stakeholders together and to support these activities actively.

Third, the stakeholder consultation had revealed that several important misconceptions exist concerning the nature of the proposed targets (for instance, some stakeholders appear to believe that uniform targets would be imposed at the European level for all municipalities). This shows that the Commission needs to communicate clearly on its actual intentions and take away any misunderstandings concerning the proposed policies.

Fourth, although we have identified no hard evidence that specific MS will not be able to reach the diversion targets of the Landfill Directive, a rigorous monitoring of the full implementation of current legislation is also important.

Finally, whatever targets would be finally chosen (if any) in a legislative proposal, clear calculation and monitoring guidelines are required to limit the administrative burdens.

⁷⁹ Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

7.8 QUALITY OF DATA AND METHODOLOGICAL ISSUES

The ARCADIS/Eunomia had already discussed extensively the lack of reliable data on biowaste generation and management within the EU. This has been confirmed by the current study.

Despite the very targeted questions that were submitted in the stakeholder consultation, most answers were essentially opinions, and contained very few quantitative facts that can be subjected to an independent verification.

Our analysis in section 4.1 has also revealed that, with the data that are currently available at the level of the EU, different econometric approaches to the forecasting of MSW can lead to quite different result. Therefore, any forecast of MSW should be interpreted with circumspection. This confirms the need for standardised reporting requirements, not only for waste generation but also for waste treatment, split up per major waste category. A more general conclusion is the need for models that forecast waste generation based upon surveys of individual households, rather than upon macro-economic data.

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ANNEX A: SUMMARY OF THE STAKEHOLDER CONSULTATION

In December 2010, the Commission launched a written consultation, addressed to Member States and other stakeholders, with the main aim of gathering in depth information on the subsidiarity aspects of setting EU-level bio-waste recycling targets. Stakeholders were invited to share their views and experiences by providing answers to a number of questions. They were encouraged to support opinions with verifiable information and preferably quantitative data, in order to strengthen the Commission's analysis on the appropriateness of setting such bio-waste recycling targets. 47 replies were received, including comments from 8 Member States (incl. Norway), 5 local authorities and their associations, 24 companies and industrial associations (mainly from the waste management and energy production sectors), 9 environmental and consumer organisations and 1 individual person. Table 13 presents a list of all respondents. All comments are publicly available at http://circa.europa.eu/Public/irc/env/biowaste_prop/library. This Annex gives an overview of the answers provided and issues raised in response to each of the questions of the consultation.

Table 13: Overview of the Member States and organisations responding to the Commission consultation of December 2010 - January 2011

Member State/Organisation name	Acronyms used
Member States	
Germany	DE
Denmark	DK
Spain	ES
France	FR
The Netherlands	NL
Norway	NO
Sweden	SE
United Kingdom	UK
Local Authorities	
AFLRA - Association of Finnish Local and Regional Authorities	AFLRA
COSLA - Convention of Scottish Local Authorities	COSLA
LGA - Local Government Association	LGA
LIPOR - Intermunicipal Waste Management Service of Porto's Region	LIPOR
Municipal Waste Europe	MWE
Companies and industrial associations	
Arge Kompost & Biogas	Arge
AfOR - Association of Organics for Recycling	AfOR
Avfall Sverige – Swedish Waste Management	AS
BDE - German Federation of Waste, Water and Raw Material Management	BDE
BGK - German Quality Assurance Organisation of Compost	BGK
BVOR - Dutch Association of Bio-waste Processors	BVOR
CEMBUREAU – European Cement Association	CEMBUREAU

CEWEP – Confederation of European Waste-to-Energy Plants	CEWEP
CIWM - Chartered Institution of Wastes Management	CIWM
Danish stakeholders: Solum, Komtek Miljø, Aalborg University, Rambøll, DAKOFA	DS
ECN – European Compost Network	ECN
FEAD - European Federation of Waste Management and Environmental Services	FEAD
FNADE - French National Federation of Waste Management and Environmental Services	FNADE
Göteborg Energi	GE
Insinkerator	-
KGVO - Austrian Compost Quality Association	KGVO
Merseyside and Halton Waste Partnership and Merseyside Brussels Office	Merseyside
MTK - Finnish Central Union of Agricultural Producers and Forest Owners	MTK
Novamont	-
Renewable Energy Association	REA
Swedish Food Retailers Federation	SFRF
VDMA - German Engineering Federation	VDMA
VKU - German Association of Local Public Utilities	VKU
Waste Denmark	WD
Environmental and consumer organisations	
AICA – International Association for Environmental Communication	AICA
CEE Bankwatch Network	CEEB
CEE Bankwatch Network and Friends of the Earth Czech Republic	CEEB & FoE CZ
EEB - European Environmental Bureau	EEB
FNE - France Nature Environnement and CNIDD – French National Centre for independent Information on Waste	FNE & CNIDD
GAIA – Global Alliance for Incinerator Alternatives	GAIA
KEPKA – Greek Consumer Protection Centre	KEPKA
SNH - Scottish Natural Heritage	SNH
SEPANSO – French Regional Federation for the Study, Protection and Development of Nature in the South-West	SEPANSO
Individuals	
Professor Chris Coggins	CC

8.1 QUESTIONS PRIMARILY AIMED AT MEMBER STATES

- 1) What measures have been taken and/or are envisaged to encourage separate collection of bio-waste (or separate sub-streams of bio-waste e.g. food waste, green waste, food production waste, catering waste) as described in Art. 22 of the new Waste Framework Directive? What are the estimated quantitative results of such measures?**

Information was provided on the policy measures of 9 Member States and Norway. A Member State level summary is given below. CZ: A new Act on Waste is currently being prepared. A preparatory document (2010) states that at least separate collection of green waste is to be established by the municipalities. Collection schemes and recovery methods are to be determined in accordance with the available technical possibilities and the environmental, economic and social acceptability criteria.

DE: The revision of the Act for Promoting Closed Substance Cycle Waste Management and Ensuring Environmentally Compatible Waste Disposal stipulates mandatory separate collection of bio-waste throughout Germany from 2015 onwards, as long as it is technologically and economically feasible. In this way it is expected to collect at least a part (perhaps 50%) of the remaining 4.6 million tonnes of bio-waste still found in mixed MSW. Treated bio-waste to be used in agriculture or gardening is subject to legal requirements regarding permissible waste streams. A landfill ban further promotes recycling or incineration of waste streams that are not suitable for recycling.

DK: Since December 2010 the WFD bio-waste definition is adopted in national legislation. Specific measures and targets for source separation have not yet been set. In the Waste Strategy '10 a series of national initiatives was launched to increase waste recycling by moving waste away from incinerators. Currently approximately 95% of the food waste generated is incinerated for energy recovery and 95% of the green waste is composted. For the latter fraction it is anticipated that 35% will be incinerated for energy recovery in the future. Municipalities are responsible for the collection and handling of household waste, while industry is obliged to take care of its own waste. To date nearly all industrial bio-waste is already separately collected and used as soil improver. Municipalities set up waste management plans, in which most of them use the exact wording of the WFD.

ES: The National Waste Management Plan establishes a general target for separate collection of bio-waste: an increase up to 2 million tonnes in 2015, which is approximately fifth fold of the separately collected amount in 2006. The draft regulation transposing the WFD has an article specifically addressed at encouraging separate collection of bio-waste. Catalonia has long lasting experience with separate collection, with quantitative separate collection targets set for kitchen waste and green waste, other regions are planning separate collection schemes in the short term.

FR: A national plan supporting home and community composting, was launched in 2006 and has since then allowed to reach an extra 1 million families. More than 4 million tonnes of bio-waste is now home composted each year. From 2012 onwards separate collection is mandatory for large bio-waste producers. Until 2016, this obligation holds for companies producing more than 50-80 tonnes/year, afterwards the limit will be lowered to 5 tonnes/year. In this way it is expected that up to 2 million tonnes of bio-waste will be recycled per year, not taking into account green waste recycling. Separate collection of household and municipal green waste is encouraged via a large network of civil amenity sites and some kerbside collection, with nearly all such wastes being composted. General waste recycling targets, which include bio-waste recycling, have been set at 35 % recycling in 2012 and 45 % recycling in 2015. The total amounts of waste landfilled or incinerated are to decrease with 15 % by 2012 as compared to 2009. Incineration and landfill capacity are legally limited to 60 % of the total waste generated in FR.

NL: Separate collection of Vegetable, Fruit and Garden waste from households is obliged since 1994. However, exemption criteria are broadly defined to ensure that enough flexibility remains for the municipalities to take into account local factors when establishing waste collection and processing schemes. Among others, high-density housings may be exempted and separate collection may be restricted to certain periods of the year or to specific bio-waste fractions (e.g. only green waste). Furthermore separate collection of (bio-)waste is promoted by measures such as public information campaigns, landfill bans, landfill taxes and minimum standards, which determine the minimum environmental performance for processing a specific waste type (such as separately collected green

waste, food and kitchen waste from restaurants, caterers and retailers, waste streams from the food industries). Recycling is the primary treatment option for bio-waste, but any other treatment option may be licensed if an LCA-study demonstrates better performance. About 1.5 million tonnes, or about 50 %, of VGF-wastes from households are separately collected each year. It is reported that this amount is not really affected by the introduction of extended exemption criteria for municipalities. Several million tonnes of green waste from parks and public areas and about 10 million tonnes of bio-waste from caterers and food processing industries are reported to be separately collected, although separate collection is not imposed by law.

NO: Landfill taxes and a ban on landfilling of biodegradable waste since 2009 stimulate alternative treatment methods for bio-waste, either biological treatment or incineration, the former implying separate collection. 75 % of the municipalities have separate collection of food waste from households.

SE: A mix of instruments such as the ban on landfilling of organic waste since 2005 and landfill taxes have increased the biological treatment of household waste to approximately 620 ktonnes in 2009, which is about three fold the amount of 1995. Governmental investment plans facilitate the establishment of compost and anaerobic digestion plants. A target on waste is set at the national level: by 2010 at least 35 % of food waste from households, restaurants, caterers and retailers, separated at the source, is to be recovered by biological treatment. By the same date food waste and comparable wastes from food processing plants etc., not mixed with other wastes and suitable for recycling into crop production, is to be recovered by biological treatment. The household waste target was not reached, but might be fulfilled by 2013. A new national target, with a slightly different formulation, focussing on the recycling outcome, is about to be proposed: by 2015 at least 40 % of food waste from households, restaurants, caterers and retailers should be treated in such a way that nutrients are brought back to the soil. A need to facilitate the participation in the collection system is identified. Sweden also reports to have an ambitious policy for biogas use as transportation fuel.

SL: Separate collection of bio-waste from households is mandatory from June 2011 onwards. A target for commercial sources will be introduced later on.

UK: Waste is a devolved matter. A landfill tax escalator and Landfill Allowance Trading Schemes act as an important driver to reduce the amounts of (bio-)waste sent to landfill and increase separate collection and recycling. The Government encourages local authorities to offer separate food waste collection and inform householders about what happens to their waste. It also provides advice to councils and businesses to increase recycling, e.g. on request, WRAP (Waste and Resources Action Plan) can provide advice and information to local authorities on all options for household organic waste collection. During 2009-2011 financial support from WRAP has allowed to expand separate food waste collection by over 580 000 households. WRAP has conducted research to provide detailed practical guidance to local authorities on collecting food waste from businesses and schools.

In England, about 40 % of the local authorities offer separate food collection or mixed food and garden waste collection, about 94 % offer garden waste collections for composting. 16 % of the household waste was sent for green recycling in 2009/10 up from 10 % in 2005/06. A review of waste policies is currently being undertaken. This review will, among other things, address the frequency and quality of rubbish collections and the promotion of anaerobic digestion. An adaptation of the definitions of recycling and composting is proposed, such that only compost and digestates meeting the respective quality protocols (PAS 100 and PAS 110) will count towards the

general WFD recycling target. (CC) Waste prevention is prioritized. A 'Love food hate waste' prevention campaign was launched in 2007.

Wales' National Waste Strategy sets minimum composting targets for source separated municipal waste: by 2009/10 at least 15 % of composting was to be reached. 14% was achieved, which is about 47 % of the bio-waste collected by local authorities. Funding was provided to local authorities in order to reach these targets, and from 2009/10 to 2010/11 an extra funding specifically aimed at setting up a separate food waste collection service. 57 % of the properties are currently being served. General reuse, recycling and composting targets are set to local authorities: at least 52 % by 2012/13, 58 % by 2015/16, 64 % by 2019/20 and 70 % by 2024/25. It is anticipated that at least 80 % of food and green waste will have to be recycled in order to reach these targets. A draft Municipal Sector Plan puts an action to local authorities to explore opportunities to increase recycling and food waste collection services for businesses.

The Scottish National Waste Management Plan states that the introduction of landfill bans will be supported by regulations to drive separate collection and treatment of a range of resources, with an initial focus on food waste. The following targets are stipulated: a 50 % recycling and composting target of household waste by 2013, increasing up to 60 % by 2020, and an overall recycling and composting level of 70 % MSW and industrial waste by 2025. The draft Zero Waste Regulations 2011 focus on separate collection and material/energy recovery from food waste. Funding will be available for local authorities implementing food waste separate collections. A 'Love food hate waste' prevention campaign was launched. Food waste trials were carried out.

In Northern Ireland, 56 % of the households receive a separate collection service for organic waste at the kerbside (2009 data). The municipal composting rate is 12.8 %. Approximately half of the organic waste is collected at the kerbside, the rest comes from household waste recycling centres. For 2010/11 funding is made available for councils to improve recycling levels, focussing on extending garden and food waste collections. A Quality Protocol for compost has been introduced in January 2011.

2) *Would the setting of a recycling target at the level described in the Annex to the Communication (36.5%) have any positive or adverse effects on bio-waste management in your country? Do you have any studies/experiences on that issue?*

Six Member States responded to this question (DE, DK, ES, NL, SE, UK). Three of them report to already meet the target (DE, NL, SE). No specific studies are referred to.

DE believes that setting an EU target below the current national practice could have adverse effects on the management of bio-waste, as national standards might have to be explained and justified. The target could be interpreted as a signal that 36.5 % of recycling would be sufficient. This concern is also expressed by a Dutch industrial federation (BVOR) stating that enforcement of current regulatory framework might be considered less of a priority, while targets which reflect the current practice would rather strengthen these practices.

SE reports that many waste operators consider the national target on food waste recycling as an important incentive for increasing biological treatment of food waste.

NL considers that the possibility of deviation from the waste hierarchy if environmentally and/or economically better options exist will actually be removed by setting bio-waste recycling targets. Flexibility for the municipalities to organise their own waste management will be reduced, while this

is believed to be crucial in order to continue to move forward. In NL, since 2009, quantitative targets for separate collection of different household waste fractions are replaced by a general recovery target of 60 % for household waste as a whole in order to ensure more effective waste management at the municipal level, taking account of local conditions. Furthermore, a bio-waste recycling target focussing on composting and AD is believed to ignore the potential benefits of other innovative ways of gaining energy from bio-waste, such as biorefineries. Recovery targets are believed to suffer less from the above disadvantages.

UK largely expresses the same concerns as NL regarding the perceived reduction of freedom for choosing the most appropriate bio-waste management options adapted to local circumstances and for developing new forms of bio-waste treatment.

DK and ES believe that a bio-waste recycling target would bring about improvements in bio-waste management and implementation of the waste hierarchy, reinforcing national legislation on the matter. DK however notes that a broadening of the scope of the target would be welcomed, since valuable types of bio-waste recycling as e.g. use as fodder or direct use as soil conditioner or fertilizer are currently not included. The DS report that targets would especially deliver added value for the part of the bio-waste contained in mixed household and mixed industrial waste: at present less than 5 % of the mixed waste is being recycled, as there is very little separate collection in DK. ES states that experiences in Catalonia with quantitative separate collection targets for kitchen waste show that results are far more significant if targets are also technically and financially supported.

NO considers that the setting of a bio-waste target would give a positive signal to industry that more recycling is desirable. However, a further mix of instruments outside the waste management sector, e.g. in the agricultural sector, the energy sector, the transport sector is deemed necessary to support this target.

Apart from the Member States, several respondents point out that where targets are already achieved, these provide no incentive to perform better (BDE, BGK, FNADE). Some suggest that targets should become progressively higher than 36.5 % (at least 50 % is suggested by some) to ensure a sufficient driver for improvement (Arge, ECN, KGVÖ, FNADE). A 25 % recycling rate would already be achievable by mainly recycling the garden waste fraction and excluding home composting.

COSLA notices that at present the tight local financial resources could be better deployed in addressing waste prevention than in installing separate collection systems, since prevention would ultimately resulting in better environmental outcomes.

FNADE points out that other forms of bio-waste recovery (MBT compost, sludges, sludge compost) are not included in the recycling target, which leads to hide the efforts made in these areas.

Furthermore concerns are raised regarding the additional administrative burdens that a bio-waste recycling target would bring about (NL, FNADE).

3) Would the setting of recycling targets at the abovementioned level improve or harm the implementation of the current legislation? In which way?

Most respondents refer to their answer to the previous question. Some specific elements related to implementation of legislation are listed below.

Several respondents believe that a bio-waste recycling target would contribute to the achievement of the objectives of the national and/or the EU legislative framework (DK, ES, CEEB, CEEB & FoE CZ, EEB, FNE & CNIID, FEAD). As regards the contribution to EU-level objectives, the following are

mentioned: contribution to the Landfill and Renewable Energy Directive targets, the waste hierarchy of the Waste Framework Directives and the objectives set in the Thematic Strategy on the Sustainable Use of Natural Resources, the Thematic Strategy for Soil Protection and the European Climate Programme. At the national level, apart from DK and ES, also some local environmental organisations (CEEB & FoE CZ, FNE & CNIID) report that a target would reinforce national legislation thereby ensuring diversion of bio-waste from incineration and landfill: in CZ quite some effort is still required to reach the MSW recycling target set (50%), and French recycling targets currently do not cover separate collection of bio-waste in MSW. Some stakeholders state that any existing legislation exceeding EU targets is unlikely to be affected. However, they also think that in case the obligations are less ambitious, additional activities would be encouraged when bio-waste recycling targets are set (Arge, KGVÖ, ECN).

In the UK no influence on the implementation of the current legislation is expected. The WFD and the Landfill Directive along with the measures already in place and continuing to be put in place are reported to be acting as sufficient drivers for improvements in bio-waste management.

NL points to inconsistency with the WFD, since the principle of Art. 4, section 2, which allows for deviations from the waste hierarchy where justified by life cycle thinking, appears to be ignored. This principle is also incorporated into Dutch legislation and the application thereof is expected to be difficult when recycling targets for bio-waste are set. NL refers to the EU-policy on waste oils which used to aim for recycling but was recently adapted based on LCA. Furthermore, possible conflicts with the policy for stimulating renewable energy and the development of innovative techniques for energy production from bio-waste are identified.

COSLA fears that consistency issues with new EU targets might emerge in Scotland, since the draft Zero Waste Regulations specify among others separate collection requirements for food waste and not for bio-waste as a whole. According to COSLA, a period of legislative certainty is needed.

4) Have any data on waste management in your country become available since the publication of the ARCADIS/Eunomia study, especially with respect to the following issues: (biodegradable) municipal waste generation (including the relative shares of food and garden waste), existing municipal waste treatment capacities (especially incinerators), planned municipal waste treatment capacities.

DE refers to the new waste statistics (2008).

DK provides for the most recent data on MSW treatment and waste incineration capacity (2008). Eight incineration plants have applied for an expansion of their current capacity. Seven of these applications have already been rejected because of the decline in the amounts of waste for incineration and the expectations of a higher recycling rate in the future.

ES gives an overview of the latest data on MSW and bio-waste collection and treatment (2008).

NL lists the most recent data on municipal/Vegetable, Fruit and Garden waste management and on incineration capacity (2008-2009). Reference to the original documents is provided for. Furthermore, it is reported that apart from VFG-waste, there is also a category of large garden waste, which is separately collected and mostly recycled. The baseline scenario in the Arcadis/Eunomia report does not take account of this specific category of bio-waste. The incineration plant categorisation (R1/D10) for NL in the Arcadis/Eunomia report is questioned: in 2007-2009 all incineration plants are to be regarded as D10 plants.

UK refers to updated statistics in the four countries (Scotland: 2008/09, England, Wales, Northern Ireland: 2009/10). Information is provided on the planned residual waste treatment infrastructure in Northern Ireland. Professor Chris Coggins provides data on AD capacities in the UK, AD process-related parameters and relevant legislative aspects. COSLA further refers to annual capacity reports of different types of waste infrastructure, a review of the currently operational waste management infrastructure and a revised Annex to the National Waste Management Plan covering the treatment capacity required to meet the Scottish Zero Waste targets. Information on the gate fees of alternative waste treatment options is referred to by AfOR.

For FR, FNE & CNIDD report that in 2009, 32.2% of the household waste was bio-waste and that the capacity of MBT in 2012 is estimated at 3 million tonnes/year. FNADE provides quantitative data on the collection, recycling and recovery of bio-wastes.

For SE, AS refers to the latest data on Swedish (household) waste management (2009).

The above data are used to adapt the baseline scenarios of the Arcadis/Eunomia report where possible.

NO also provides data on the amounts of bio-waste generated, collected and treated.

5) One of the objections raised against uniform bio-waste recycling targets is that they would penalise countries that have in the past heavily invested in incineration capacity. What is the age structure of the municipal waste incinerators in your country? If there was a move away from incineration to municipal waste treatment, what alternative sources of waste would end up in incinerators to fill their capacity?

DK reports that the average age of Danish incineration plants is quite high, many of them planning to renew their incinerators within the next 10 years or close down. A number of incineration plants have co-incinerated biomass, especially straw, but this is a more expensive fuel than municipal waste. It is still uncertain whether the legalisation of imports and exports of non-MSW for incineration (December 2010) could offer a profitable solution for incineration plants to fill up any surplus capacity that might occur.

With 10 incineration facilities being able to treat about 10 % of the MSW generated per year, ES has a relatively low incineration capacity. Therefore, it is believed that recycling targets can be set without affecting the investments made in incineration capacity. The reported age structure is as follows: 18 % of the incinerators have been built before 1985, 46 % in the '90s and 36 % after 2000.

NL expects that installed incineration capacity will not be very much affected by the setting of bio-waste recycling targets, since most of the Dutch bio-waste is already not incinerated. However, other industries, which in the past have invested in specific routes for bio-waste treatment e.g. as a secondary fuel, might be penalised. The following incinerator age structure is reported:

- 1970-1980: 3 incineration lines
- 1980-1990: 1 line
- 1990-2000: 5 lines
- 2000-2010: 1 line
- 2010- : 4 lines

It is noted that many plants have also made investments during their lifetime: old facilities have installed modernized flue gas cleaning equipment and recently investments were made mainly to improve heat recovery, among others encouraged by the opportunity to qualify for the R1 status.

FR reports that only 2 incinerators have been installed in the last 4 years, and one incinerator is still under construction. However, most incinerators have been modernised in 2005 in order to comply with the national emission limits for dioxins. The share of incineration in waste treatment is expected to decrease following legislative provisions.

SE notices that the main issue is not filling up the excess capacity of the incinerators, but finding alternative fuels for the district heating system. These alternative fuels could include non-waste biofuels or imported waste. AS reports that so far there has been no conflict of interests between incineration and biological treatment in SE.

The UK reports that there are 21 municipal waste incinerators in England and Wales, 11 of which are over 10 years old, 5 between 5 and 10 years old and 6 are less than 5 years old. In England there are also over 20 waste-from-energy plants at various stages of development. Northern Ireland has no incineration capacity at present, but one plant might be constructed shortly. COSLA reports that the new Scottish Zero Waste Regulations propose the introduction of limits of waste types which can be used as a feedstock for incineration plants.

Several stakeholders (Arge, KGVÖ, ECN) mention that if garden waste is included, the bio-waste recycling target can be met even while bio-waste incineration rates are high. It is stressed that, with the exception of woody fractions and fats, the lower energy efficiency of bio-waste for incineration actually promotes bio-waste recycling.

CEWEP notes that experience in e.g. AT, BE, DE, NL shows that high quality recycling goes hand in hand with waste-to-energy incineration, the latter covering the remaining part, which is not clean enough for the recycling activities.

6) *Has your country changed its support schemes for renewable energy, especially renewable energy coming from waste management, since the publication of the ARCADIS/Eunomia study (or is it planning to do so)?*

DE: DE is currently transposing the European legislation on biofuels, which includes using waste to improve sustainability. Some stakeholders (Arge, KGVÖ, ECN) report that the German Renewable Energy Act has been modified such that it became easier to treat some organic waste materials without losing the subsidies.

DK: In 2009 an agreement on Green Growth was launched. One of the goals is to use up to 50% of Danish livestock manure for green energy in 2020. In October 2010 the incineration tax on household waste was repealed.

ES: The Spanish National Action Plan for Renewable Energies 2010-2020 includes among others:

- Extension of the legislation on special taxes providing for conditions for the use of biogas as a vehicle fuel similar to the ones for biodiesel and bio-ethanol.
- A feed-in tariff system supporting the inclusion of biogas in the natural gas network.
- A feed-in tariff system favouring the electricity production from renewable resources, including biogas, with a minimum energy efficiency level.

NL: No changes have been carried out yet, but a new support system is being elaborated.

FR: An increase in landfill and incineration taxes is planned, an augmentation of the purchase rate of electricity from biogas is scheduled in 2011 and a feed-in tariff system for biogas injected into the gas network will be installed. The level of these taxes and tariffs is not yet known.

SE: The incineration tax on household waste has been removed and plants have been included in the Emissions Trading System.

UK: There have been several changes and announcements about future planned changes to the support schemes for renewable energy. In April 2010 a feed-in tariff system was introduced to incentivise small scale (< 5MW) low carbon electricity generation. Anaerobic digestion is among the supported technologies. The tariffs for AD are reported.

The Renewables Obligation (RO) obliges licensed electricity suppliers to source a specified and annually increasing proportion of their annual sales from renewable resources or pay a penalty. A review of the RO was carried out. As of April 2009 different technologies receive different numbers of Renewables Obligation Certificates (ROCs) per MWh. Generators can sell their ROCs to suppliers or traders. At present, energy from waste plants with CHP receive 1 ROC/MWh, while advanced combustion technologies (gasification, pyrolysis, etc.) and AD receive 2 ROCs/MWh. In July 2010 it was announced that support within the RO for biomass, energy from waste, AD, gasification and pyrolysis will be fixed for 20 years. A scheduled review of the bands under the RO for new entrants or technologies for which the support hasn't been fixed is ongoing. New bands will come into effect in April 2013. The Scottish Government has recently closed a consultation on proposed changes to the Scottish RO in addition to the UK-level changes (COSLA). These proposed adaptations mainly concern the coverage of bands for wave and tidal power and the support for biomass generation.

In December 2010 the UK Government issued a consultation on proposals for fundamental reforms of the electricity market. Proposals include:

- The introduction of a carbon price floor, providing greater certainty to the carbon price in order to increase investments in low carbon generation.
- Long term contracts for low carbon generation
- Additional payments to encourage the construction of reserve plants or demand reduction measures to ensure that there remains an adequate safety cushion of capacity as the amount of intermittent and inflexible low carbon generation processes increases.
- A back-stop limit to how much carbon the dirties power stations can emit.

Renewable energy generators will participate in auctions for contracts in a system called a contract for difference (CFD) feed-in tariff. This will involve the government offering top-up payments to generators if wholesale energy payments are low, while claiming money back when prices are high. (CC)

A Renewable Heat Incentive will be launched in 2011, intending to provide long term support for renewable heat technologies.

8.2 QUESTIONS FOR ALL STAKEHOLDERS

- 1) *Added Value of EU legislation. Would setting a recycling/separate collection target for bio-waste deliver added value in comparison with current legislative regime (including the Landfill Directive and the Waste Framework Directive, especially Art 4 and 22,) if this existing legislative regime is fully implemented?***

Several stakeholders feel that, first of all, a clarification of the definition of bio-waste is needed in order to substantiate any comments or opinions. Some believe that defining a target for

biodegradable waste is more straightforward (LGA, MWE), stating that the treatment method should not depend on whether or not biomaterials are processed into food or other products, while others prefer the WFD definition (Arge, KGVÖ, ECN). Different opinions exist on whether or not separate collection should be a prerequisite for inclusion of bio-waste into the recycling target and if so, how separate collection should be defined: does it mean that a distinction has to be made between green waste and kitchen waste? (COSLA) Furthermore, concerns are raised regarding the calculation of the recycling target: the calculation should be established in a reliable and unambiguous way, based on a verifiable data source (Arge, ECN, KGVÖ, AS, MWE, EEB, AS), since different calculations can lead to very different results (FNADE). Therefore, a clear delineation of the type/fraction/origin of waste the target setting refers to (inclusion or not of home composting, waste from the food processing industry, organic waste from retailers, park and garden waste from private, public and commercial sources, sewage sludge compost, the organic fraction of mixed waste intended to be used on land, other organic residues such as paper mill sludge etc. (Arge, ECN, KGVÖ)), and a guidance on how targets can be monitored are believed to be indispensable if any target is set. (see further, question 5)

As far as the added value of a bio-waste recycling target is concerned, opinions differ widely. On the one hand many stakeholders believe that the existing European policy framework shows some gaps as regards bio-waste management: the Landfill Directive specifies the treatment method that should not be used, but targets can easily be reached by diverting biodegradable waste to incineration or MBT, while these will not be the environmentally or economically most preferable methods in most or all cases. (DE, ES, CEEB, Arge, KGVÖ, ECN, FEAD) Moreover, the Landfill Directive is limited to municipal biodegradable wastes. Requirements for separate collection are not included. Furthermore, the interpretation of the WFD is not always straightforward (GAIA), the Directive remains very general. Art. 22 of the WFD calls for measures to encourage separate collection as well as environmentally sound treatment and use of the materials produced from bio-waste, but no binding targets or measures are defined. (DE, FNE & CNIID, CEEB, FEAD, FNADE, Novamont) It is argued that other EU policies clearly indicate the driving effects of targets, i.e. the Packaging Directive, the Renewable Energy Directive and the Landfill Directive. (Arge, KGVÖ, ECN)

The following advantages of binding recycling/separate collection targets are mentioned:

- Binding targets at EU-level are thought to be useful for giving Member States a clear policy goal (DE, LIPOR, CEEB & FoE CZ, FNE & CNIID, FEAD), while maintaining a certain flexibility to adapt the waste management schemes to specific local conditions (EEB, AfOR).
- They would create a flexible and cost-effective recycling option, which can easily be adapted to local conditions. (Arge, KGVÖ, ECN, FEAD)
- They would provide long term legal certainty for industry, banks, investors, local authorities. (DE, NO, FNE & CNIID, EEB, Arge, KGVÖ, ECN, FEAD, BVOR, AfOR)
- They would contribute to a better implementation of the existing legislation e.g. the waste hierarchy and achievement of the WFD or Landfill Directive targets, (LIPOR, CEEB & FoE CZ, FNE & CNIID, CEEB, EEB, Novamont, BVOR, AS, CIWM, AfOR) but would also help to achieve the goals of the Thematic Strategy for Soil Protection, the Thematic Strategy on the Sustainable Use of Natural Resources and the European Climate Change Programme. (ES, FEAD)
- They would provide for a market-pull mechanism to complement the market-push mechanisms of the WFD and the Landfill Directive (FEAD)

- Clear targets would also lead to more careful examination of the best options for bio-waste treatment. This is believed to be particularly important when deciding how much MBT or incineration capacity must be installed, as such decisions will influence bio-waste treatment for years or decades. (DE, CEEB, GAIA) Bio-waste recycling targets would prevent Member States from - mainly due to lack of knowledge or experience - systematically recurring to MBT, incineration or landfill as the most cost-effective options in the short term, while not investing in dedicated facilities which are more sustainable and profitable on the long term. (CEEb, Arge, KGVÖ, ECN)
- Binding targets would stimulate Member States to take advantage of the important potential of bio-waste recycling to contribute to soil and climate protection and savings of resources such as fuel, nutrients etc. (ES, Arge, KGVÖ, ECN, VKU, FEAD, BVOR, GE, LIPOR)
- They would help meeting European market and customer demands for quality assured composts and digestates. (Arge, KGVÖ, ECN, FEAD)
- They would provide an incentive for Member States to set up public awareness campaigns and green public procurement strategies to promote waste prevention in general. (Arge, KGVÖ, ECN, FEAD)
- They would lead to a better handling of other wastes. (SEPANSO). Experience in Catalonia demonstrates a need for separate collection of bio-waste to increase the separate collection rates of other municipal waste streams above 20-35%. (ES)
- High quality recycling would be stimulated and low quality recycling, such as the production and use of compost from MBT, discouraged if a separate collection requirement is included. (FNE & CNIID, AICA, VKU, BDE, BGK)
- Local job creation and economic growth can be expected (CEEb, EEB, Arge, KGVÖ, ECN, FEAD)
- Promoting bio-waste treatment does not preclude other treatments and helps to improve the efficiency of other bio-waste treatments such as incineration. (ES)

On the other hand various respondents are of the opinion that the proposed recycling targets deliver no real added value. The following reasons and concerns were provided:

- Examples, such as NL, demonstrate that based on the existing legislation, good bio-waste management is possible (NL).
- LCA studies in NL have shown that none of the bio-waste management options considered had any clear environmental advantages over the other options, with the exception of landfilling, which proved to be clearly disadvantageous. The Landfill Directive already tackles this issue. (NL)
- Better implementation and enforcement of the current legislation is preferred. (NL, UK, CEMBUREAU) As suggested by the baseline scenario of the Commission's Communication (UK), substantial environmental improvements can be expected from the full implementation of the existent legislation. (WD, Merseyside, CEMBUREAU)
- Apart from the WFD and the Landfill Directive, also the renewable energy requirements will strengthen biological treatment (anaerobic digestion). (MWE)
- In the UK, the WFD re-use and recycling target for household waste is interpreted as 50 % of the totality of waste from households. Given that bio-waste is such a large proportion, bio-waste recycling rates have to increase anyway to meet the target. (UK)
- Flexibility is essential for Member States and local authorities to establish locally optimal waste management solutions, based on lifecycle thinking. The proposed EU-level recycling targets might reduce this flexibility. (NL, AFLRA, MWE, COSLA, SNH, WD, Merseyside, LGA)

- Recycling targets might hinder the development of new technologies for bio-waste treatment. (NL, UK)
- New EU legislation invariably leads to additional administrative burden. (NL)
- A high recycling target could affect prevention and home composting, discouraging the promotion of the waste hierarchy. By placing the responsibility upon councils to collect, measure and dispose of bio-waste, the opportunity of community involvement is believed to be reduced. (LGA)
- The costs for local authorities could increase, which would be a burden especially in the current economic climate. (LGA)
- Recycling targets could conflict with (local) renewable energy schemes. (LGA, VDMA)
- Existing waste management contracts could be compromised. (LGA)
- New bio-waste targets would add a further level of complexity to the implementation of WFD and Landfill Directive targets. (LGA, Merseyside)
- Any actions on bio-waste would place a heavy burden on a waste stream measuring less than 9 % of the total amount of waste generated in Europe. (MWE)
- Bio-waste can include a large proportion of garden and park waste, which can also be recycled in relatively simple biodegradable waste treatment facilities (such as home composting installations) with stable results. (MWE)
- Conflicts with national and regional legislation might arise, a period of legislative certainty is needed. (COSLA)

FR adds that bio-waste management policy should focus on limiting environmental and health risks associated with inappropriate bio-waste management. The reduction of methane emissions should be the principal objective, which can be reached by reducing the quantities of biodegradable wastes going to landfill and/or by increasing the effort to capture methane emissions from landfill. French policy has prioritised separate collection and recycling of green waste and food waste from large producers, and believes that recycling objectives for household bio-waste can also be realised by mixed waste collection.

Several respondents state that in any case the importance of prevention by e.g. food banks, home composting, information campaigns should be stressed. (KEPKA, COSLA, VKU) Prevention actions provide more environmental advantages and should be prioritised. The relaxation of the standards for fruit and vegetables, allowing a wider variety of sizes and shapes to be sold, is believed to be a good example of EU-level support for prevention. (COSLA)

Furthermore, various stakeholders mention that there has to be an assured market/need for the collected bio-waste materials and the products resulting from bio-waste treatment, to accompany any targets set (MTK, LGA, VKU). MTK mentions that in FI examples are known of separately collected bio-waste ending up at landfill sites due to lack of processing facilities or waste quality.

There appear to be some misunderstandings as regards the proposed bio-waste recycling target:

- Some stakeholders seem to interpret the target as if home composting were not included. E.g. AFLRA comments that in FI large quantities of bio-waste are home composted, which is considered appropriate since many areas are sparsely populated. It is stated that therefore, binding separate collection or recycling targets are not supported.
- For others it seems unclear whether or not waste from industrial sources such as food processing is included. E.g. FNADE substantiate their statement that the calculation methodology

should be clarified, with some examples. These examples include bio-waste from industrial sources.

2) Areas not appropriate for separate collection. The Report of the European Parliament on bio-waste (A7-0203/2010)⁸⁰ suggests that separate collection should be mandatory with the exception of those areas where this is not the appropriate option from the environmental and economic points of view. Do you have any experiences or assessment linked to the selection of such areas?

Several respondents state that in principle, separate collection is possible in all areas (DS, BDE, BGK, CEEB & FoE CZ)

Many stakeholders mention that in the following situations separate collection schemes may experience some difficulties and require specific solutions:

- **in rural areas** where the large collection distances between dwellings increase transport costs and home composting is usually well established (DE, ES, FR, UK, AFLRA, LGA, Arge, KGVÖ, ECN, MTK, Novamont, CIWM, AfOR, FNE & CNIID, AICA, CEEB):

It is widely recognised that in those areas home composting or community composting might be technically and economically more feasible than centralized composting, especially when promoted effectively. Several examples of successful home composting campaigns are provided. An analysis of home composting diversion in several localities in England estimates that on average 115 kg of bio-waste/household/year could be home composted⁸¹ (AfOR). Other possible solutions include decentralized collection schemes which support on-farm treatment and respect short distance transport, (Arge, ECN, KGVÖ, AfOR), collection by means of adapted vehicles with two chambers (bio-waste and residual waste) to save on transport costs (Arge, ECN, KGVÖ), or the use of Household Waste Recycling Centres (AfOR).

Some stakeholders add that experience proves that high quality separate collection and composting can be achieved in rural areas. (ES, BDE, BGK, Novamont, BVOR)

- **in densely populated areas and multi-occupancy housings** (DE, ES, FR, NL, Arge, ECN, KGVÖ, VKU, BVOR):

In these areas experience shows that problems with the amount and quality of the collected bio-waste tend to arise. A summary report of 21 food trials conducted by local authorities in England (2007-2009)⁸² states that the lower yields obtained in multi-occupancy housings may be attributed to the smaller household sizes and the greater difficulties in providing accessible, convenient collections and managing multiple containers. The findings of the report suggest a need for additional strategies for collecting food waste from these properties.

Other reasons reported for yield and quality issues are: lack of space (FR), lack of awareness/acceptance of the importance of separate collection and the associated environmental benefits (ES, FR, COSLA), limited potential to retro-fit waste receptacles (COSLA), inappropriate housing infrastructure (Arge, ECN, KGVÖ).

⁸⁰ <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONGM+REPORT+A7-2010-0203+0+DOC+PDF+V0//EN&language=EN>

⁸¹ Davey, A., Clist, S. Godley, A. (2009). Home Composting Diversion: Household Level Analysis. Evaluating the effectiveness of home composting in diverting waste away from local authority kerbside collections. WRAP

⁸² WRAP (2009). Evaluation of the WRAP Separate Food Waste Collection Trials – final report –updated June 2009.

Nevertheless, examples - in among others Vienna, Munich, Milan, and Barcelona (Arge, ECN, KGVÖ) - demonstrate that successful collection schemes can be set up, if people are regularly informed and motivated. (BDE, BGK, Novamont). A comprehensive study specifically looking into effective recycling schemes for flats⁸³, confirms that collecting bio-waste under such circumstances is challenging, but can be achieved in certain conditions (AfOR). As with any collection scheme, the provision of a high amount of information to participants is paramount.

Insinkerator refers to studies showing that the introduction of food waste disposal units (FWD) might offer an interesting alternative to separate collection in areas such as flatted properties, where participation rate is usually low. FDW are reported to be easy to use and to have a proven very high satisfaction score. They have also been shown to improve the yield of other recyclables.⁸⁴ CC and Insinkerator claim that a recent research project in a town in SE, where 50 % of the households use FWD, has disproved most of the objections to FWD⁸⁵. Biogas production increased by 46 % while waste water treatment works operating costs did not increase. They believe that FWD can contribute to the recycling of food waste that would otherwise not be collected.

COSLA reports that IE has identified a population density approach to food waste collections.

- in deprived areas:

The English food trials additionally showed that trials in more affluent areas tended to achieve higher participation and yields in comparison to trials operating in less affluent areas.

- in areas with a particular geogenic/pedogenic conditions:

In areas showing a high background concentration of heavy metals, separate collection and composting could still be beneficial, but the use of composts resulting from garden and park waste should be restricted to that same area. (Arge, ECN, KGVÖ)

VDMA adds that from their experience, only states with efficient charge fees for waste management are able to run a sustainable waste management system, allowing for separate collection and treatment.

Many stakeholders do not favour EU-level mandatory separate collection with derogations for certain areas. Some respondents argue that the introduction of separate collection/recycling targets is more appropriate, since it leaves more freedom to the Member States to decide where and under which conditions separate collection should be introduced, such that locally optimal collection schemes can be found. (Arge, ECN, KGVÖ, BVOR) EEB favours an approach with staged objectives, giving Member States the time to learn and improve the separate collection process. Others point to the social impacts of mandatory separate collection: MWE notes that non-acceptance often leads to reduced amounts or lower quality of the collected wastes and AS mentions that studies demonstrate that the quality of collected bio-waste is better in optional than in mandatory systems. Similarly, COSLA states that in densely populated areas there is a need to first concentrate on changing

⁸³ Defra (2006). Recycling for flats. planning, monitoring, evaluating and the communication of recycling schemes for flats with case studies from the UK and abroad.

⁸⁴ Yang, X., Okashiro, T., Kuniyasu, K. & Ohmori, H. (2010). Impact of food waste disposers on the generation rate and characteristics of municipal solid waste. *Journal of Material Cycles Waste Management*, 12, 17-24.

⁸⁵ Evans, T.D., Andersson, P., Wievegg, A. Carlsson, I. (2010). Surahammar – a case study of the impacts of installing food waste disposers in fifty percent of households. *Water Environmental Journal*, 241, 309-319.

attitudes rather than behaviour. Most opponents of EU-level separate collection targets state that waste collection decisions should always be adapted to local conditions and be left to the Member States and/or local authorities. FNADE suggests maintaining general subsidiarity, but encouraging separate collection through Regional Waste Management Plans.

NL stresses that their extensive experience in separate collection of bio-waste shows that it is important for municipalities to have enough flexibility in the design/management of their waste. Therefore in 2008, the separate collection obligation was relaxed by extending the exemptions allowed. Among others, high-density housings may be exempted and separate collection may be restricted to certain periods of the year or to specific bio-waste fractions (e.g. only green waste). COSLA adds that given the highly diverse geographical, economic and social settings within the EU it is unlikely that a set of simple and clear criteria could be outlined which would leave sufficient flexibility for the local authorities to organise their waste service provision.

SE reports that their target for collection and biological treatment of food waste was set on a national level, precisely because biological treatment might not be the best treatment option everywhere. Conditions to be taken into account are the quality of the waste, the composition and the available markets for the different products created, such as electricity, heat, biogas, compost and digestate.

COSLA further emphasises the importance of the legislative formulation: the Scottish Zero Waste regulations contain a clause that separate food waste collection is mandatory to the extent that separate collection and carriage would not be technically, environmentally or economically practicable. This kind of formulation is believed to increase the uncertainty for waste collection authorities. EEB similarly states that stipulating mandatory separate collection except where inappropriate due to environmental and economic conditions, would lead to difficult discussions regarding the appropriateness of areas.

According to GAIA, caution is needed when defining appropriateness: e.g. transport of compost from areas with non-degraded soils to areas with severe soil degradation (e.g. Finland to Spain) might not make sense from the point of view of a short-term cost benefit analysis. However, taking account of all effects of soil degradation on the longer term, they claim that it might turn out to be beneficial to use compost from the north - while replacing the use of bio-waste for energy purposes by other renewable sources of energy - to fight soil degradation in the south.

3) *Differentiated targets. Do you see a possibility of setting differentiated recycling/separate collection targets for different Member States? What criteria in your opinion could be used for such differentiation?*

Most stakeholders are not in favour of differentiated target-level setting. Different arguments are reported:

- First of all, it is noticed that it would be very difficult to agree on the different target levels and criteria by 27 Member States with various local conditions and interests. (NL, Arge, ECN, KGVÖ)
- Different levels are expected to distort the competition between Member States and could bring about important waste flows towards Member States with less ambitious objectives (FR). This would not be conducive to creating a level playing field (NL).
- EU targets set at a national level already allow for a degree of flexibility to the varying regions and municipalities within a Member State. (AfOR)

- The proportion of the compostable/fermentable fraction in municipal waste lies within similar ranges in all Member States. (Arge, ECN, KGVÖ)
- Doubts arise whether there would be a scientific basis for target differentiation between Member States. (SFRF)
- It would become difficult to compare the efficiencies of national bio-waste management strategies. (FNADE)

It is however generally agreed that, given the highly differing current recycling levels between Member States, some kind of differentiation will be needed if EU-level targets are set. Following the example of the Landfill Directive, setting different deadlines for reaching a final recycling level, is considered a possible solution. (DE, ES, FR, Arge, KGVÖ, ECN, BGK, Novamont, BVOR, FNE & CNIID, CEEB, EEB)

Several respondents suggest to set gradually increasing targets to allow for sufficient lead in times for those countries which are currently lagging behind in terms of bio-waste collection/recycling (AS, AfOR, CEEB), as well as to incentivise progress in those Member States already reaching the proposed targets (FNADE, GAIA). VKU adds that target setting at levels already achieved, should not be allowed.

The following possible criteria for differentiation are mentioned:

- The current recycling or recovery level (FR, FNADE, CIWM, GAIA)
- The bio-waste management at a certain date, before entry in to force of the WFD (CEEB, EEB)
- The level of implementation of the WFD (CEMBUREAU)
- The current level of landfilling (SE)
- Aligned with the Landfill Directive (EEB)

MWE reports that differentiated targets can also be based on the result of the treatment option used, replacing non-waste sources of nutrients or energy. Treatment processes with high quality results, fulfilling established standards should be promoted.

DS considers that laying down minimum targets at EU-level would avoid the need for differentiated target setting.

A few respondents simply state that in order to adequately address local circumstances, differentiated targets should be set (MTK, REA). MTK reports that they should be set at national, regional and local level. REA adds that criteria should be based on increases in the existing level of collection.

LIPOR reports that in any case all Member States should follow the same philosophy and concepts, based on the waste hierarchy and aiming for a high quality of the products produced.

4) *Bio-waste from food production. The analysis of case studies on food production waste demonstrated that this waste is usually re-used or recycled within agricultural and related industries, e.g. as animal feed. Case studies show that the quality of this waste is stable which allows its re-use or recycling in good economic and safety conditions. For these reasons, bio-waste from industrial sources was excluded from recycling targets discussed in the Annex. Could you provide evidence contradicting the above statement and demonstrating the need of setting recycling targets for bio-waste from food production?*

Many stakeholders agree with the statement that the quality of bio-waste from food production industries is stable and is usually reused and recycled with good results (ES, FR, NO, SE, VDMA, DS, MTK, BVOR, AS, FNE & CNIID, AICA). Some examples are provided:

- FR reports that bio-wastes from the food production industry are mostly considered as by-products or sub-products and that they are currently almost entirely being reused or recycled. The food industry will be subject to mandatory separate collection and valorisation of bio-waste from 2012 onwards.
- In SE half of the food production waste is used as animal feed, while the remaining part is generally treated biologically, with only a small amount being incinerated.
- In DK 99 % of the industrial biodegradable waste is re-used (47 % as feedstock, 44 % as fertilizer on farmland, 8 % for biogas production) and 1 % is landfilled. If it is used as a fertilizer for agricultural purposes, it has to apply with Danish quality regulations. Furthermore, a large amount of by-products is re-used or recycled. (DS)

Nevertheless some respondents are of the opinion that a target is needed or might be useful for bio-waste from food production industries. (ES, SE, AFLRA, MWE, Arge, ECN, KGVÖ, BDE, FNADE, AfOR, CC, CEEB)

This is justified by different arguments:

- Such a target could encourage bio-waste recycling and contribute to reach the targets set in the Landfill Directive (ES, Arge, ECN, KGVÖ)
- It could contribute to a higher protection of animals from contaminated feedstuff. (Arge, ECN, KGVÖ, BGK) Sufficient bio-waste treatment capacities allow for better implementation of the Animal By Products Regulation (ABPR), making agricultural and feeding alternatives to biological treatment less attractive. This is illustrated by recent developments in DE, where food and food production waste going for biological treatment between 2005 and 2006 (start ABPR) increased with 20 %.⁸⁶ Latest researches show that currently most of this waste is treated in anaerobic digestion plants.⁸⁷ (Arge, ECN, KGVÖ)
- A continued and increased re-use or recycling should be ensured, since the current praxis might easily change when market conditions, prices or administrative burdens change. (MWE, VKU)
- The objectives to be achieved are the same for food production wastes as for municipal bio-wastes: enhance recycling, contribute to soil improvement, lower greenhouse gas emissions, close material loops etc. (FNADE)

Some of these respondents argue that municipal bio-wastes and those resulting from food production should be included in the same recycling target. (Arge, ECN, KGVÖ) The following reasons are provided:

- High variations between quantities of garden waste between different Member States (e.g. Mediterranean vs. Northern European Member States) could be balanced with the inclusion of food production waste, in this way stimulating biological treatment.

⁸⁶ Kern, M., Raussen, T., Funda, K., Lootsma, A. & Hofmann H. (2010). Aufwand und Nutzen einer optimierten Bioabfallverwertung hinsichtlich Energieeffizienz, Klima- und Ressourcenschutz.. UBA-texte No 43/2010. Available at: <http://www.uba.de/uba-info-medien/4010.html>

⁸⁷ IFEU (2008) Optimierungen für einen nachhaltigen Ausbau der Biogaserzeugung und –nutzung in Deutschland.

- Such feedstocks have similar properties, are often treated through the same technologies and increasingly managed together (co-composting, co-digestion) with positive results. (FNADE, AfOR, CC). E.g. in the UK Biogen Greenfinch and Fernbrook Bio use both food waste feedstock from industrial and municipal sources. Synergies could be promoted.

Meanwhile Novamont and EEB state that if a target is set for food production waste, it should in any case be a separate target so as to avoid a reduced efficacy of the target for MSW bio-waste. EEB adds that specific targets for post-consumer bio-waste (a distinction could be made between household waste, restaurant waste, retailer waste were relevant) should not prevent synergies between bio-waste streams. Other respondents agree that synergies between household and food production waste should be promoted (AFLRA), as long as there is a quality check to avoid contamination (CEEB).

Several remarks were added:

- MWE stresses that in any case animals must be protected from unsuitable feedstuff and the ABPR must be taken into account for target setting. CIWM adds that they do not support the use of processed food in animal feed, due to historical incidents of Food and Mouth.
- On the other hand, CC points to the potential of encouraging livestock feeding: it has been argued that in contrast to AD and composting, feeding food to livestock gives twice the savings in CO₂ emissions, The UK chose to ban the practice after an outbreak of food and mouth, traced back to illegal feeding practices, rather to elaborate regulations for controlling these illegal feeding practices.
- NL mentions that it is important to realise that part of the waste from the food processing industries is well suitable for use as a secondary fuel, so only considering re-use and recycling is too limited.
- LIPOR states that a thorough analysis should be carried out of both cases, inclusion and exclusion of bio-waste from the food production industry in the recycling target, in order to determine the most sustainable solution.
- COSLA believes that a more robust assessment on the respective benefits of the available waste treatment technologies needs to be undertaken, and final choices should be based on LCA.
- Several stakeholders suggest that in any case the bio-waste (recycling) data from the food production industry should be recorded (REA) and reported (Arge, ECN, KGVÖ)

5) Form of recycling targets. What are in your opinion the advantages and disadvantages of setting targets:

- a) for the recycling of bio-waste expressed as the amount of bio-waste subject to composting or anaerobic digestion and resulting with the production of quality compost/digestate;***
- b) for the separate collection of bio-waste, leaving Member States freedom to choose further treatment of collected bio-waste?***

Opinions on the most appropriate form of a target for improving bio-waste recycling differ widely. Some stakeholders prefer option a) (BVOR, FNADE, AS, GE, CIWM, REA), others option b) (DE, LIPOR, BDE, BGK, AfOR, CEMBUREAU), several respondents are not in favour of setting EU-level bio-waste recycling/collection targets in general (FR, UK, NL, AFLRA, LGA, MWE), some prefer another type of recycling/collection target (SE, VDMA, DS, FEAD, FNE & CNIID) and others are of the opinion that a

combination of separate collection and biological treatment is the best way to fully explore the environmental benefits of the resource. (ES, Arge, ECN, KGVÖ, VKU, Novamont, CEEB, EEB)

The **advantages** reported for **a)** are:

- Recycling targets will function as a driver for high quality bio-waste recycling and closing material loops. (LIPOR, BGK, WD, Novamont, AfOR, CEEB & FoE CZ, GAIA) This supports the implementation of the waste hierarchy (DS) and ensures the preservation of a maximum amount of carbon and nutrients from compost/digestate for soil improvement. (Arge, ECN, KGVÖ, BVOR, SEPANSO)
- They discourage less preferable treatments only aiming at reducing the quantity of bio-wastes (GAIA)
- The quality requirements will greatly enhance the market acceptance of the resulting composts/digestates. (AfOR, GAIA) The formation of European market for compost/digestate and treatment technologies is stimulated. (GAIA)
- There can be no 'sham' recycling: input and output of the recycling process would be recorded. (CIWM) More reliable data and reporting are expected (GAIA)

The **disadvantages** reported for **a)** are:

- Quality compost/digestate needs to be defined. (DE, BGK, GAIA) End-of-Waste (EOW) criteria could be useful, but have not been defined yet. (DE)
- The option reduces the Member States' freedom to choose the most appropriate bio-waste management option cf. Art. 4 of the WFD. (UK)
- If separate collection is not included in the definition of bio-waste recycling, this might lead to operators performing to the lowest acceptable compost/digestate quality limits (AfOR), which might jeopardize markets for high quality composts. (Arge, ECN, KGVÖ, BVOR, FNE & CNIID)
- Three aspects have to be measured: (1) the amount of bio-waste, (2) the amount of bio-waste sent to composting or AD (3) the amount of compost/digestate complying with certain quality criteria. (MWE)
- As only AD and composting count towards the recycling target, this hampers the use development of new technologies. (NL, UK, DS, MTK, CEMBUREAU) AfOR adds that other technologies such as ATAD (Auto Thermal Aerobic Digestion) and CHC (Combined Heat and Aerobic Composting) should also be considered as valuable options.
- The target does not include other types of bio-fertilisers containing food waste, which may represent high recycling rates (e.g. food waste co-digested with sludge). (Insinkerator)
- The definition of recycling should be broader than defined by end-of-waste criteria. It should rather encompass the 'reprocessing of organic matter'. (FEAD)

The **advantages** reported for **b)** are:

- b) leaves more flexibility to Member States/local authorities to choose the environmentally and economically best option adapted to the local circumstances. (DE, AfOR, CEEB & FoE CZ, GAIA)
- Separate collection is an essential prerequisite for high quality compost/digestate (DE, Arge, ECN, KGVÖ, BGK, Novamont, BVOR)
- It will act as a driver in terms of feedstock security in the future (AfOR), and thereby helps to put into place a well-functioning waste and biomass market. (CEMBUREAU)

- Open to other uses of separately collected bio-waste: food production waste can be used as animal feed and a certain part of the wood fraction of garden waste can be used for bio-mass incineration. (Arge, ECN, KGVÖ)
- Collection targets would prevent Member States from not investing in bio-waste recycling because they are unsure what the effort separate collection would mean in practice. (DE)
- They would avoid the need for defining a set of quality criteria (in case the EOW criteria are not suitable or delayed) (DE)

The **disadvantages** reported for **b)** are

- A separate collection target does not focus on the results to be achieved (high quality composts/digestates), it has no other justification than ensuring the quality of input materials for specific technologies. Member States should be free to decide how to reach the goals set. (FR, WD)
- A separate collection target does not guarantee that the collected material is biologically treated (SE, Insinkerator, CIWM), especially where landfill is the normal treatment (NL). A mix of incentives is needed (SE). b) leaves the door open to technologies that are lower in the waste management hierarchy such as MBT and energy recovery. (Novamont, BVOR) Insinkerator adds that in some areas separately collected bio-waste is incinerated due to the presence of contaminants.
- It might lead to an unbalanced amount of bio-waste being incinerated for energy and heat recovery. (Arge, ECN, KGVÖ, GE) GE reports that experience in SE shows that separately collected bio-waste is incinerated, which should be avoided as other efficient sources of green electricity and heat exist.
- Mandatory separate collection is not in harmony with the waste hierarchy conditions, the subsidiarity principle and the ambitions to allow as much regional/local flexibility as possible (MWE)
- The resulting statistics on bio-waste recycling would be less reliable and calculated based on different standards. (GAIA)
- It would be an insufficient driver to create a European market for technologies and compost/digestate. (GAIA)

The following reported **disadvantages** hold for both **a)** and **b)**:

- The currently available data might not suffice for accurate target calculation. (DE) DE suggests to introduce an EWC-waste code for separately collected bio-waste. Target calculation would still be complicated, as precise information on the amount of bio-waste in mixed municipal waste is not available.
- Due to the differences in current recycling levels, finding an appropriate target level will be difficult. (FEAD)
- A recycling/separate collection target mobilises large quantities of garden waste which were previously managed in the garden. The latter is a preferable strategy according to the waste hierarchy. (FNE & CNIID)

Many stakeholders suggest alternatives to recycling targets or a different formulation thereof:

- AS suggests that specifying a less precise recycling target, as e.g. one third or 30 % recycling of bio-waste would make more sense, due to inevitable data uncertainty.

- Several stakeholders suggest to (gradually) increase the recycling target to at least 50 % (Arge, ECN, KGVÖ, GAIA). GAIA proposes a 80 or 90 % target for those Member States already reaching 50 %. BGK suggests staged target setting up to 75 % recycling of the total amount of bio-waste produced in 2010, to be reached in 2020.
- Various respondents prefer a target specifying a certain % of bio-waste to be separately collected **and** biologically treated. (Arge, ECN, KGVÖ, EEB)
- DE believes that a recycling target based on e.g. kg per capita might create less of an additional bureaucratic burden than targets expressed in % of all bio-waste.
- SE states that the target should focus on the benefits of biological treatment, on the outcome, which is to produce biogas, avoid methane emissions and to bring nutrients and humus back to the soil. Therefore the proposal for a new target for food waste in SE is formulated as “at least 40 % of food waste from households, restaurants, caterers and retailers should be treated in such a way that nutrients are brought back to the soil” (see question 1 of the previous section). The choice of the treatment method should be up to the Member States/local authorities in accordance with local conditions.
- DS similarly states that the target formulation should emphasise that AD and composting are examples of bio-waste recycling, leaving room for technology development and choice of the optimal treatment method by local authorities/Member States.
- FEAD suggests the elaboration of a target on the minimum recycled matter content in growing media, soil improvers and fertilisers. For fertilisers the target should include a minimum level of N, P or K from renewable sources, while for growing media, account should be taken of the need to save non-renewable organic matter as peat and keep the soil organic matter content stable. Such a target would address the need to protect soils and recycle limited nutrient resources such as phosphorous and would stimulate the demand for bio-waste products, acting as a catalyst for infrastructure development.
- According to AFLRA binding EU legislation on national planning and target setting for bio-waste would be useful.
- GAIA suggests a progressive ban on incineration to 0 % incineration of bio degradable waste by 2025.
- Various stakeholders point to the potential of revising the Landfill Directive. (COSLA, WD, SE) WD states that if further progress is wished, a broadening of the scope of the landfill diversion targets, increasing these targets or even a ban on the landfilling of biodegradable wastes could be considered. SE suggests sharpening the targets in the Landfill Directive, introducing a ban on landfilling bio-waste from 2021 onwards.
- Several respondents believe that co-existence between recycling and energy recovery is desirable for a sustainable waste management policy and therefore suggest to set recovery targets. (NL, VDMA) VDMA however states that setting reasonable targets for different technologies, possibly including quality standards, could also be a valuable solution.
- Merseyside suggests to move away from tonnage based waste recycling targets, towards a better measure of the total environmental impact of waste, incorporating carbon and resource use.
- Insinkerator states that the leading principle should be to try to best suit to the local conditions such as population density, soil needs, compost markets, renewable energy production. A more effective incentive might therefore be to stipulate a compulsory minimum landfill tax to be charged by each Member State.

- FNE & CNIID are of the opinion that the recycling target should only cover food waste, not green wastes. All households produce food waste, also those who do not have a garden for home composting.
- Various respondents suggest to formulate the target as a maximum organic waste content of residual waste, in % (AICA) or in kg per capita per year (FNE & CNIID) This kind of target would cover both prevention and recycling.
- Several stakeholders would prefer home and community composting to be considered as prevention, not recycling (CEEB & FoE CZ, ECN, Arge, KGVÖ). CEEB & FoE CZ adds that a separate prevention target would be welcomed.

Several remarks are added:

- VKU stresses the importance of local flexibility in choosing the optimal treatment method and opposes to imposing a comprehensive list of process requirements or measures for recycling or separate collection. Minimal requirements are set by the BREF and the unilateral promotion of certain technologies, impairing other types of material use, should be avoided. Separate collection and high quality recycling/recovery should be the general rule, but exemptions must be allowed based on local sustainability.
- A recycling target should be complemented by a percentage of separately collected bio-waste and digested bio-waste, to allow for comparisons between Member States' performances/strategies. (GE)

6) *Separate collection – barriers. As separate collection should provide better waste management at comparable cost, one could expect that no additional legislative support is necessary. Based on your experience, please provide information about any barriers encountered which delay or prevent introduction of separate collection at national, regional or local level.*

The following barriers to separate collection are reported:

Technical/knowledge barriers

- Difficulties in finding outlets for compost (NO), especially when the quality is low. (NL) (see question 7)
- Lack of experience and knowledge about successful collection schemes (ES), cost and fee structures, basic requirements of biological treatment technologies, compost quality, use and markets. (Arge, ECN, KGVÖ, Novamont) Perceived additional cost of collection. (CIWM, REA, FNE & CNIID, EEB)
- Lack of experience and knowledge of authorities, operators (Novamont), or citizens (REA) about the benefits of separate collection (MTK) and biological treatment.
- The unavailability of sufficient infrastructure to treat the bio-waste. (UK, MTK, AfOR, CEEB & FoE CZ) Market confidence is needed for new facilities to be built. (AfOR)
- Lack of an unambiguous definition of separate collection. It is unclear whether comingled collections of food and garden waste are allowed, while many technologies adequately deal with a combination of garden and food waste. (COSLA, LGA)
- The existence of a number of technologies, which can adequately treat mixed waste and extract bio-waste. (LGA)
- The availability of free capacity in other waste treatment and disposal installations such as mixed MSW treatment facilities, incineration plants or landfills (BDE, BGK, DS, Novamont, BVOR,

FNE & CNIID), which are in many cases the most cost-effective options once the investments has been made. (CEEB, EEB)

- The presence of vacuum collection systems (food waste disposers). (WD)
- Physical limitations to the storage of multiple containers in certain housing types (WD).
- Lack of adequate collection equipment. (MTK, REA)
- The fact that separate collection does not always guarantee high quality treatment results: a part of the bio-waste cannot be used for composting/AD due to quality issues. (FR)
- Lack of substantiated and exhaustive data on the pros and cons of separate collection throughout the EU. (FNADE)

Financial barriers

- The economic uncertainty of the business. (MTK)
- The cost of separate collection (CC, LGA, AS, AfOR), which exceeds the cost of mixed collection. (FR, SE, COSLA, Insinkerator) (see also question 11) Account needs to be taken of the collection bins, the transport costs, the vehicle costs (AfOR), the cost of the source separation activity and the cost of space for dedicated separate collection. (MWE) The type of housing influences the costs of separate collection. (WD) FR reports an additional cost of 30 %. CC notices that the pressure on collection cost may lead to reduction of the collection frequency or the introduction of comingled collections of e.g. food and garden waste. This may increase the potential for contamination.
- Despite the demand for feedstock for anaerobic digestion, this is not reflected in the prices paid for these materials. (SFRF)
- Biological treatment of separately collected bio-waste is currently not cost-effective in DE. However, a waste management system might be more cost-efficient with separate collection than without. (VKU)
- The costs of awareness-raising campaigns may be significant. (COSLA)
- The costs of switching may be significant. (WD)

Organisational barriers

- Separate collection is challenging in several areas such as rural or very densely populated areas/high rise buildings. (cf. the answers to question 2) (DE, NL, UK)
- Problems to adapt the existing collection contracts to the new requirements. (ES, Arge, ECN, KGVÖ, AfOR)
- Municipalities need to be able to fluctuate the frequency of separate collection when appropriate. E.g. in some cases in summer amounts of bio-waste collected decrease due to citizens wanting to avoid a bad smell, while in other cases amounts decrease in winter time, since less garden waste arises. (NL) WD adds that climate conditions influence the necessary collection frequency.
- When different authorities are responsible for collection and waste treatment, a holistic approach, taking advantage of integrated collection and treatment cost management, is hindered. E.g. in FR municipalities are responsible for collection and another administrative level for the treatment. (FNE & CNIID, EEB)

Social barriers

- The acceptance of separate collection by citizens may be difficult (COSLA, Insinkerator, CIWM, EEB), despite many awareness-raising campaigns. (NL)

- There is a lack of trust in the willingness and ability of citizens to participate in separate collection schemes. (Novamont, FNE & CNIID)
- Consumer behaviour is influenced by many factors (WD), which require a specific approach. (UK) Several studies in the UK^{88 89} point out that the main barriers to household participation in food waste collections are:
 - concerns about potential hygiene, odour or vermin issues, although these were considered less important by participants, indicating that these are often perceived issues rather than reality.
 - the perception of not producing enough food waste, although evidence shows that all sectors of the population generate food waste.
 - using food in other ways (home composting, pet feeding), although most households are also likely to produce a quantity of food waste that cannot be used that way.
 - not wanting to make the effort.
 - having a low interest in recycling generally.

Participation tends to be lower amongst young people, students, unemployed people, very small or very large households, some minority ethnic households and those living in conversion flats and private rented property. Places with concentrations of private rented property and high residential mobility are identified as areas where it will be especially difficult to achieve high participation in food recycling.

Yields also proved to be dependent on the frequency of the collection and the containers used. The yields obtained with collection schemes comprising weekly food waste collections and fortnightly refuse collections were generally higher in comparison to trials with weekly refuse collections. Some trials experienced a drop-off in participation, which emphasises the importance of engaging with householders in order to maintain participation levels.

In order to improve collections, additional research is needed, the specific problems of inner city areas are to be recognised and continuous support for developing a social norm on sustainable food behaviour, including communications, is believed to be indispensable.

- Health and safety at home, during the bio-waste collections and during the processing might constitute a barrier. (CC)
- There is an a priori poor acceptability of compost produced from household bio-waste. (CEEB & FoE CZ, CEEB, EEB)

Political barriers

- The resulting gains can only be perceived on the long term and cannot easily be translated into economic benefits, while political decisions mainly consider the short term and prioritize immediate economic benefits. (ES) Integrated, strategic and progressive planning is needed. (Novamont, AfOR) Lack of commitment of the national/local authorities, (LIPOR, CEMBUREAU) not wanting to disappoint their electors (SEPANSO, FNE & CNIID).

⁸⁸ Defra (2009). Enhancing Participation in Kitchen Waste Collections. Defra Waste & Resources Evidence Programme WR0209, 38 p. Available at: http://randd.defra.gov.uk/Document.aspx?Document=WR0209_8618_FRP.pdf

⁸⁹ WRAP (2009). Evaluation of the WRAP Separate Food Waste Collection Trials – final report – updated June 2009.

- The need for financial support for the introduction of separate collection schemes (materials, awareness-raising campaigns, vehicles, etc.), due to the difficulty to impose the real costs to citizens. (ES)
- Low landfill fees (ES, Insinkerator) and taxes which do not reflect the external/environmental costs. This creates a biased economic competition. (Arge, ECN, KGVÖ, Novamont)
- Lack of technicians in local governments, which makes adequate dimensioning of the waste management services difficult. (ES)
- Licensing requirements for biological treatment plants, which increase the costs. (Arge, ECN, KGVÖ)
- Insufficient budget for education and awareness-raising. (Arge, ECN, KGVÖ, Novamont, AfOR)
- Contracting schemes which leave the collection and treatment framework to pure market forces, only taking account of economic and not ecological criteria. (Arge, ECN, KGVÖ)
- Subsidies diverting bio-waste towards other treatment methods. (Novamont) E.g. European funding programmes (cohesion/structural funds) favouring large scale and costly treatment facilities such as incineration plants, MBT installations and landfills. (Arge, ECN, KGVÖ)
- An uncertain legislative framework (Novamont), lack of legislative push to create market and investor confidence (BVOR) and lack of effective pressure to implement national waste management plans with separate collection systems. (CEMBUREAU)
- The split of waste management responsibilities between local and regional/national authorities: it is difficult for municipalities to invest in biological treatment options and separate collection if a higher administrative level favours another waste treatment method. (GAIA)

7) Compost markets. With high distances between the installations treating bio-waste and soils that require compost/digestate, transportation costs are relatively high compared to the market value of compost and are one of the potential barriers in the wider dissemination of biological treatment of bio-waste. Other market-related problems signalled to the Commission include: finding outlets for produced compost/digestate, especially in more urbanized areas; concerns with respect to the quality of compost; competition with manure as a fertilizer. Can you give examples for the failure of compost markets due to the factors mentioned above, or other factors?

Many stakeholders mention that market issues occur when compost quality is insufficient.

The following examples of quality issues are provided:

- The UK reports that quality issues of some biodegradable waste derived materials have undermined the confidence in and markets for quality composts in Scotland.
- AFLRA mentions that municipal bio-waste composts have mainly been used for landfill cover or landscaping, rather than for agricultural purposes. This is because the agricultural sector so far has shown a negative attitude towards these product and likewise towards wastewater treatment plant sludges. Only recently this attitude has been changing.
- BGK notes that DE has learned from past experiences with mixed municipal waste composting. Compost quality failed consumer expectations, which led to a bad image for composts. Now, after approximately 20 years of composting separately collected bio-wastes with a recognised quality assurance system, markets of compost are well-developed.
- FNE & CNIID report that in several areas in FR, where mixed waste compost has been applied for several years, farmers discover many visual soil contaminants, particularly plastics. In these areas it appears to be difficult to rebuild confidence in compost. High quality composts on

the other hand are seen as valuable resources and transported across FR or even imported from DE.

- GAIA provides an example from Barcelona, where due to lack of experience and installations, separately collected bio-waste has been mixed with bio-waste from an MBT installation. It is reported that both wastes have ended up being anaerobically digested, processed into RDF and burnt in incinerators and cement kilns.

Various respondents point to competition with manure as a fertiliser. Some examples are given:

- in Jutland (Western part of Denmark) manure is said to compete heavily with composts and other organic materials. Due to this kind of competition, Danish compost often finds other markets than the agricultural and is used e.g. in parks, greenhouses, soccer and golf courses etc. However, bio-waste and manure are also digested together in biogas plants (75 % manure, 25 % organic waste), the resulting product being popular as a fertilizer in DK.
- BVOR reports that in the past competition with manure has led to compost marketing problems in NL. Since a few years the demand for compost exceeds the production, even though farmers pay to get rid of animal manure.

NO mentions that difficulties are experienced in finding outlets for compost. New biogas plants seem to take this issue into consideration when locating their businesses, making early agreements with farmers for digestate use.

As for transportation issues:

- SE mentions that transportation costs are a major problem for digestate recycling. Actions are taken to reduce the costs e.g. studies on the dewatering of digestate are ongoing, pipelines for transporting digestate to arable land are/will be installed (AS).
- GAIA indicates that examples in Catalonia (ES) and Campania (IT) demonstrate that composting infrastructure is not always well located. Municipalities sometimes have to send their separately collected organic fraction to installations at more than 150 km distance.

Apart from the above issues, several other factors contributing to market failures are described:

- Several respondents report that competition arises with other biodegradable waste derived materials, which need to find a market such as sewage sludge (FR), paper sludge waste, shredded green 'waste' and compost-like outputs of MBT. (UK) CIWM notices that competition with sewage sludge will probably increase when a sewage sludge ban from landfill will be established.
- Also restrictions imposed to nitrate vulnerable zones are expected affect the market for bio-waste derived materials. (CC, CIWM)
- Arge, ECN and KGVÖ state that the main starting point failure is the belief that the market will establish itself. As for all new products, market development is indispensable. Compost and digestate thereby face the specific challenge of waste derived products: creating confidence by high quality, quality control/assurance and reasonable application information is key.
- GE points to the fact that the Council Regulation EC 834/2007 on Organic Production and Labelling of Organic Products prohibits the use of digested slaughterhouse waste in organic farming. Hence, it becomes increasingly difficult to find outlets for the digestates originating from these products. As such, also the production of biogas for vehicle fuels is impaired.

- AfOR mentions that barriers from food assurance schemes on the use of bio-waste derived products are still significant. E.g. Quality Meat Scotland bans the use of food waste derived compost to farm assured land for livestock production. Green waste derived compost is not allowed to be used on grazing land either. These products are believed to entail unacceptable bio-security risks.
- SEPANSO points out that the low prices of chemical fertilisers constitute an important reason for farmers not being interested in composts.

Some further issues mentioned are:

- Lack of knowledge and experience of operators as well as potential clients. (Novamont)
- Unsuitable CN-ratios of the composts. (CC)
- Unfavourable overall mass and energy balances. (CC)
- Unpleasant odours. (CC)

Several examples of well-functioning compost markets are provided:

- DE reports that a stable compost market is present, as consumer acceptance is very high and strict legislation guarantees safe use and quality. Quality assurance has been in place for a long time. High distances are not a major problem, among others because bio-waste is often treated by farmers, who either use the compost/digestates themselves or have good contacts with colleges.
- In DK, ecological farmers have decided to fade out the use of conventional manure as a fertilizer. Therefore they are in search of alternative organic fertilizers and separately collected household waste and compost have been given high priority. Thus, a new market for compost is under development. The Danish Government plans to install 60 new biogas plants, 10 of which will mainly digest biodegradable waste from households, restaurants and catering, the digestate being destined for ecological agriculture. (DS)
- NL reports that, although compost markets and prices fluctuate, no structural market-problems occur. The benefits of good quality composts are well recognised and demand exceeds supply. (BVOR)
- In FR, finding outlets for compost is not a problem in general, since the agricultural area is significant and prices for compost are limited. Local authorities or industry first assess the demand before deciding to produce composts from bio-waste. (FNADE)
- SE reports that compost is mainly used as a fertilizer in parks, not for agricultural purposes.

Some general suggestions and comments are made:

- Many stakeholders repeat that ensuring high compost quality is essential for increasing user confidence and developing a stable market. An elaborated marketing strategy is believed to be indispensable. It is generally acknowledged that product differentiation could contribute to market development.
- Several respondents believe that the elaboration of End-of-Waste criteria for compost and digestate may help to overcome distance issues and contribute to boosting compost/digestate markets. (FR, NL)
- Arge, ECN and KGVÖ feel that distance issues should be seen in perspective: composting and digestion plants are normally situated outside city centres with arable land within a reasonable distance. Hence, a local market is present nearly everywhere, besides a few areas in Europe with high density of livestock inducing competition with manure. Even in

urban areas compost can be used for e.g. hobby gardening and landscaping. Interest in compost-based growing media is increasing, especially when reference to the local source of the compost is made in the marketing. BDE adds that in DE, the majority of the composts is marketed within a regional area of about 25 km. EEB notes that synergies created with large producers (restaurants, farmers) can contribute to reducing transportation distances/costs and increasing acceptability. Farmers could even be involved in the management of composting plants.

- A number of respondents emphasise that the manure issues are actually based on a misunderstanding: composts are soil improvers and rarely contain sufficient nutrients to be classified as a fertiliser. In many cases composts and fertilisers/manure are complementary. (FNE & CNIID, CEEB, EEB)
- EEB believes that setting staged objectives, maintaining a certain flexibility to Member States, is a way to mitigate the risk linked to the current limited compost markets. Member States can start where existing markets can be anticipated or exist and build on these experiences to eventually create extended markets for compost.
- According to Arge, ECN and KGVÖ in all countries where a mature market for compost/digestate exists, the demand for high quality products exceeds the supply.
- AfOR notes that the rising costs of fertilizer will undoubtedly strengthen markets for compost and digestate. A recent report from the Soil Association⁹⁰ indicates that mined phosphorous, which is widely used by farmers as a fertiliser, will run out after 2033. As a result, compost will become a more valuable commodity. Additionally, the potential demand will be amplified due to the need for sustainable soil amendments.
- Insinkerator points out that all parameters influencing compost markets should actually be taken into account in an impact assessment before deciding on investments in a specific bio-waste treatment methodology.
- Some stakeholders stress that most compost related market problems also hold for digestate (MWE) and for manure (VDMA).

8) *Good and bad practices. The Communication includes examples of Member States which made strong efforts towards the successful introduction of separate collection in order to ensure high quality recycling. According to the Green Paper on bio-waste, "in all regions where separate collection has been introduced it is regarded a successful waste management option" (supported by a list of success stories⁹¹). While this statement was sometimes contested, would you have examples of a failure of separate collection systems and reasons behind such failures?*

Several stakeholders are not aware of any examples of complete failures. (DE, UK, Arge, ECN, KGVÖ, BDE, BGK, AS, SEPANSO, AICA) However, it is repeated that some schemes are more successful than others and therefore local optimisations are necessary e.g. voluntary/mandatory separate collection, collection fees, collection scheme, bin/bag types and volumes. The systems used must be clean and easy for householders to improve participation. (UK, DS, Insinkerator)

⁹⁰ Soil association (2010). A rock and a hard place – Peak phosphorous and the threat to our food security. Available at: <http://www.soilassociation.org/LinkClick.aspx?fileticket=eeGPQJORrkW%3D&tabid=57>

⁹¹ see e.g. http://ec.europa.eu/environment/waste/publications/compost_success_stories.htm

VKU mentions that the success story report does not include the experiences of countries and regions, which have a long term experience in developing bio-waste management systems.

Various positive experiences were reported:

- AFLRA provides reference to some examples of the successful introduction of collection schemes in FI.
- CEEB & FoE CZ provides examples of positive experiences with the introduction of home composting and community composting systems and separate collection:
 - o A small village with 600 inhabitants started a community composting programme in 2009. 6 community composters were located near the apartments in the village centre and waste bins as well as biodegradable bags were provided. Compost may be used by all householders and for public areas, the contributing householders receiving a 10% price reduction.
 - o In a town of < 30 000 inhabitants, home composting was encouraged offering home composters of recyclable plastic at a reduced price to more than 900 households. It is reported that this saved the city 80 000 CZ crowns. In 2008 separate collection was introduced by means of road containers for kitchen waste and garden waste, available from April to November. This is considered the more economically advantageous option since the price difference with mixed collection and landfilling would amount to 1661 CZ crowns per tonne.
- CEEB refers to successful practices in Flanders, where municipal companies organise actions to distribute compost to citizens at discounted prices or for free.
- AICA mentions several success stories in villages and big cities (quarters of Turin, Rome, Naples) throughout Italy (north, centre, south, islands).

A number of examples of separate collection failures were provided:

- ES reports that in Catalonia 700 municipalities have introduced separate collections, and only three have abandoned it so far. Two of these re-introduced the collection systems once they managed to overcome their problems. Several factors explain these failures: bad dimensioning of the collection system, high management costs of the bio-waste fraction, lack of political consensus, limited implication of the competent authorities, inadequate awareness raising campaigns, collection contract issues. These problems are similar to those encountered for separately collection other waste fractions and have been gradually solved.
- FR mentions that in various communities low collection yields and quality compromise the profitability of the waste treatment installations, especially anaerobic digestion plants (Le Robert, Montpellier, Lille,..). In other cases quality issues call for additional treatments (Varennnes-Jarcy). The introduction of weight based collection tariffs for households is expected to improve the quantitative performance of the collection systems.
- NL refers to the obstacles experienced by several municipalities and mentioned in the response to question 6: inner city issues, the need to fluctuate the frequency of the collection, the participation rate, the lack of treatment capacity and problems with the marketing of the products. BVOR adds that the problems experienced in densely populated areas do not contribute significantly to the overall potential for separate collection and recycling, since the overall amount of bio-waste produced in these areas is relatively small.
- CC provides an example of an AD plant in Ludlow (a part of the New Technology Demonstrator Programme of the UK Government Department Defra) that functioned well with weekly

kitchen waste collections but was recently closed down. For cost saving reasons (225 000 £/year), food, garden and cardboard waste will be collected together and brought to a composting plant as this will be the more appropriate treatment for the new feedstock.

- COSLA refers to the findings of the Scottish Food Waste Trials, which – similar to the English ones – show a clear decrease in yield over time. The results demonstrated that 60 % of the participants become more aware of the amount of food waste they produce and 30 % had made positive changes to reduce this amount⁹². This is regarded as a failure in terms of long-term viability of the separate collection of food waste. CC adds that the success of waste prevention campaigns makes future forecasting of the available quantities of feedstock for biological treatment difficult and could pose problems for the access of AD/composting plants to suitable feedstock.
- LIPOR reports an unsuccessful experience of separate collection in apartments, where quality issues occurred. Therefore, they decided to set up a collection scheme for one-family housings only and invest in communication and best practice workshops.
- WD relates the experience of the city of Aarhus (DK), where a separate collection system was introduced in 2001. This system included the supply of the necessary equipment, free of charge, and widespread launching campaigns. Collection yields and quality did not meet the expectations and after a year an action programme was set up. Surveys were conducted to assess the users' satisfaction. In 2004 an environmental and economic assessment was carried out and the separate collection scheme was abolished.
- Insinkerator reports that in DE, the level of physical contaminants in kerbside collected bio-waste is reported to have increased from an initial 4 % to 20 % as citizens' enthusiasm for separate collection declined⁹³. Furthermore, according to Insinkerator, SE has had difficulties to achieve a 35 % recycling target by kerbside collections. Swedish cities such as Malmö and Stockholm are reported to having achieved this target by encouraging FWD. Rotterdam (NL) and Aarhus (DK) have changed from composting separately collected food waste to incineration.
- AfOR states that examples where separate collection has resulted in problems include the collection of comingled green waste and paper/cardboard. Two reasons are provided: paper and cardboard are likely to include other contaminants (plastic films, staples, etc.) and in winter months, low amounts of nitrogen in the green waste stream lead to unsuitable CN-ratios of the feedstock, hindering an effective composting process.
- FNE & CNIID as well as EEB report that in FR a number of attempts to organise comingled kitchen and garden waste collection have led to mainly green waste being collected. This green waste was previously managed in the garden.
- AICA refers to cases where quality issues arose when bio-waste was collected by means of road containers or LDPE bags⁹⁴.

⁹² Apart from this prevention effect, the drop-off in participation after initial enthusiasm, as experienced English food trials (see question 6), might contribute to this decrease in yield.

⁹³ Riedel, F. (2008) Turning contaminated waste into clean renewable energy and PAS 110 compost – an overview of the Inter Engineering bio-waste process. Proceedings of the 13th European Biosolids & Organic resources Conference & Workshop. Aqua-Enviro, Wakefield.

⁹⁴ Low Density Poly Ethylene

- MTK reports that in FI, cases are known of separately collected bio-waste ending up on landfill sites, due to the unavailability of processing facilities or quality issues.
- CEMBUREAU reports that examples can be found in the press of countries with a poorly developed national waste supply chain, such as Bulgaria, Romania and Greece.

9) Differences in national practices. Do you have any evidence for country-specific factors that explain why some Member States have progressed further in bio-waste recycling than others? Do you have any evidence indicating that some individual Member States will not be able to meet the diversion targets of the Landfill Directive?

Several stakeholders state that there are no country-specific factors, which could prevent Member States from bio-waste recycling and meeting the Landfill Directive targets. (SE, Arge, ECN, KGVÖ, VDMA) Various respondents refer to their answers to previous questions, notably to question 6 on barriers to implement separate collection and question 1 of the previous section on national measures taken to encourage separate collection.

Among others, the following factors are believed to affect a Member State's performance as regards bio-waste recycling and diversion from landfill:

- Differences in local/national political ambitions and practices: a good positive political will, coupled with financial and legislative drivers is needed. (ES, SE, Arge, ECN, KGVÖ, CIWM, AfOR)
- Different mixes of instruments contribute to landfill diversion and bio-waste recycling. Mentioned are:
 - o Landfill taxes and landfill bans (FR, NL, SE, DK, AfOR, BEEB), which should assure that landfill is not the cheapest waste treatment method (VDMA)
 - o Financial support: investment programmes and funding (ES, SE, Arge, ECN, KGVÖ)
 - o Effective fee systems (VDMA)
 - o Effective fiscal drivers (AfOR)
 - o Ambitious targets e.g. for separate collection or recycling. (BDE, CEEB) The only region with a well-developed separate collection system in ES is Catalonia, which has an ordinance stipulating mandatory separate collection of bio-waste. (GAIA)
 - o Obligatory treatment (CEEB)
 - o Quality assurance systems (BDE, AfOR)
 - o Environmental regulations, which force sustainable waste management and the environmentally sound use of waste-derived products. (BGK)
- Guidance and a framework to work towards are indispensable. (AfOR)
- Some Member States take EU legislation more seriously than others. (BVOR)
- A progressive planning system, with a positive perception of waste management leads to advanced levels of recycling. (AfOR)
- Member states with high recycling rates have established an integrated approach covering the whole process from separate collection to treatments, quality assurance systems and uses. This increases user confidence and gives legal certainty to investors. (ES) Integrated cost management also makes separate collection and recycling more cost-effective (CEEB)
- Long-term experience in bio-waste collection and recycling leads to efficient systems for bio-waste management e.g. in DE bio-waste composting started 30 years ago and quality assurance exist since more than 20 years. (BDE, BGK, CEEB)

- Experience in the use of compost and digestate to improve soil conditions is a driver for recycling that some Member States have over others. (CIWM)
- Recognition of the benefits of bio-waste recycling is key. Communication to a wide audience, as done by WRAP in the UK, results in great appreciation of collection, treatment and use of bio-waste derived materials. (Afor) Education/communication must target citizens, as well as local decision makers. (CEEB)
- A long lasting tradition of using other waste management practices leads to less advanced recycling practices. An example of this is the tradition of mixed waste incineration for energy recovery in DK (DS) and of incineration/MBT plants in FR. (FNE & CNIID) A new role needs to be defined for these facilities.
- Long-term experiences with environmental legislation and interest in environmental and health issues contribute to the presence of advanced environmental practices. (BVOR)
- Lack of space contributes to the successful diversion of organic waste from landfills. (NL)
- In PT the existence of different waste management strategies allows for comparison of performances and identifying best practices. (LIPOR)
- In SE almost all cities have district heating systems, which have facilitated the introduction of highly efficient CHP installations using waste as a fuel (10 % of the district heating systems) thereby diverting waste from landfill. It is however believed that there is a demand for heat everywhere, so the demand side for energy recovery from waste should never really be an issue. (SE)
- Leaving householders the choice for different bio-waste management options enables to maximize recycling. E.g. kerbside collection or FWD (Insinkerator)
- Garden waste is limited in Mediterranean areas. (Arge, ECN, KGVÖ)
- The presence of effective collection systems and monitoring systems is key. (VDMA)
- The responsibilities of waste generators, collectors, disposers, etc. need to be clearly defined

10) Experiences with waste treatment technologies. Are you aware of any advantages or drawback of waste treatment technologies that have not been discussed in the ARCADIS/Eunomia study?

FR and SE mention the rapid development of AD for the treatment of agricultural wastes, household waste/food waste or even kitchen waste of restaurants.

A few stakeholders mention that some promising techniques and treatment methods have not been discussed. Examples are:

- The biochar process, which is still at lab scale. (Arge, ECN, KVGÖ, BVOR)
- The Danish REnescience® technology, which will shortly be scaled up to industrial capacity. (WD, DS) The technology enables the achievement of significantly higher electrical efficiencies from waste than the thermal treatment of waste in a waste-to-energy plant. Waste sorting is not required. The process consists of several phases and produces solid recyclables, a solid fuel consisting of mainly low-grade plastics and a bio-liquid, which is highly suitable for biogas and/or bio-ethanol production. The Technical University of Denmark is currently evaluating the environmental aspects.
- Gasification and pyrolysis (DS)
- Wet oxidation (DS)

- Auto Thermal Aerobic Digestion (ATAD) and Combined Heat and Aerobic Composting (CHC) (AfOR)
- Treatment of biological residues by bacteria or algae to transform it into e.g. fish feed (SFRF)

Furthermore, it is reported that the use of the resulting bio-waste derived products should be thoroughly investigated. Nutrients and biogas must be used for any environmental benefit of biological treatment to occur. (MWE, VKU)

SFRF notes that possible synergies between different biological waste streams should be addressed. Focussing on a specific bio-waste sub-stream may not hamper the treatment and use of other organic waste streams.

CC points to the issue of weighing the mass balance against the energy balance, the issue of producing composts/digestates versus electricity, heat and fuels. Furthermore, some technical difficulties of the AD process are highlighted, such as the need for pre-preparation such as screening, shredding and pulping when using kitchen waste as a feedstock, the potential contamination problems with e.g. bioplastics, bin liners, non-plain cardboard packaging, the need for de-packaging equipment, the changes in feedstock and treatment requirements following the adapted ABPR rules on hygienisation and disinfection etc.

Insinkerator reports that food waste disposers have not been considered. Their potential for recycling or for maximizing recycling in conjunction with other collection options should be assessed.

CEMBUREAU emphasises the role of co-processing of bio-waste in the production of cement. The European cement industry uses approximately 20 % of pure biomass in its fuel mix as well as some alternative fuels containing a bio-waste fraction. This substitutes important quantities of non-renewable resources and lowers GHG emissions. This practice could further be developed provided bio-waste remains accessible.

AfOR points to the advantage of composting as compared to other treatment processes in terms of the lower associated gate fees. As a result of the current economic downturn in the UK and the anticipated competition for feedstock, this advantage might even be exaggerated.

NL refers to their detailed comments to the draft ARCADIS/Eunomia study. The weaknesses discussed mainly consider:

- The financial side, notably the monetisation of environmental impacts.
- The approach to accounting for CO₂-emissions.
- The assumptions made and associated uncertainties.
- The analysis is considered unbalanced, favouring biological treatment methods over others.
- The side effects of treatment options such as the risk of contaminants are not fully assessed.
- The assumption of full and correct implementation of the existing EU legislation does not reflect reality. NL feels that the benefits to be achieved with full implementation of the existing legislation might be higher than the additional benefits of any new bio-waste related legislation. To quantify these benefits, both the actual situation and the situation of full implementation need to be described.
- Some other treatment methods such as incineration with energy recovery and promising developments such as biorefineries are not considered
- The relationship with other EU policy fields notably the contribution to EU goals with regard to waste prevention and renewable energy should be taken into account.
- Differences between Member States are not treated consistently

11) Costs of separate collection. ARCADIS/Eunomia assumed that separate collection was economically neutral, supported by some evidence. Are you aware of any other costs assessments referring to separate collection of bio-waste, prepared at national, regional or local level (especially conducted during last 5 years)?

Please note that the statements provided below reflect the opinion of the different stakeholders and do not necessarily represent the view of the consultant.

In general, many stakeholders did not directly answer the question, as they did not provide new evidence as they were asked for, they rather provided their impressions and opinion. Please note therefore that, if not clearly indicated, the statements are not based on studies.

The following main topics were approached by the stakeholders:

Cost increase

Several stakeholders estimate that separate collection creates additional costs: SE states that separate collection is more expensive, LGA states that it would especially increase costs for local authorities.

A list of logistical elements which contribute to the cost of separate collection (which according to them cannot render separate collection cost-neutral) is given by two actors (Insinkerator, CC): bins, liners, more frequent collections, adapted vehicles, staff training, awareness and education campaigns etc.

According to AS, a study showed that in Sweden households with separate collection of kitchen waste paid 11 % more (per year) for waste collection than household with mixed household waste.

Cost neutrality

Some stakeholders consider the costs of separate collection as neutral (AICA, FNE + CNIID), at least when the collection is optimised. Another actor (MWE) however that even if separate collection may be neutral, the costs for source or secondary separation (burdening households, businesses etc.) are not included.

Assessment of collection costs

ECN thinks that it is not the right way to have a look at mass related unit costs for separate collection as they do not demonstrate the effective cost savings of the entire waste collection scheme per household or inhabitant which could be achieved with the introduction of a separate collection.

Lack of integrated collection

Both CEEB and EEB criticise the inability to take advantage of cost savings by integrated collection (which can be due to a lack of knowledge on how to optimize collection).

Local context and conditions

Several stakeholders (FNADE, WD, VKU) mention that the costs are largely dependent on the local context and conditions, e.g. the local costs of treatment, the type of housing etc.

Education and awareness raising measures

Several stakeholders (COSLA, Novamont) explain that apart from purely logistical costs for separate collection, necessary education and awareness raising measures also have to be taken into account.

Future studies/assessments

FR indicates that a study comparing, among others, the costs of separate and mixed waste collection will be published in 2012.

Please find below all statements organised by stakeholder group.

MEMBER STATES

The Member States who answered this question did not provide any new evidence in terms of cost assessments or studies which had not already been analysed in the ARCADIS/Eunomia study (see UK and DE, studies already cited in the study). Without referring to any assessment/study, SE states that separate collection is more expensive, but that municipalities offer preferential fees in order to not burden the households. FR indicates that a study comparing, among others, the costs of separate and mixed waste collection will be published in 2012.

The remaining Member States not cited here have not provided an answer to this question or state that they are not aware of any new cost assessments.

SE: The *treatment* costs are comparable for incineration and biological treatment in Sweden. However, **the cost of *collection* is higher for biowaste which is to be treated biologically than biowaste that is to be incinerated. That does not necessarily mean that the households have to pay more for separate collection. On the contrary, many municipalities offer lower fees if the households separate the biowaste from the rest than if all waste is collected for incineration.**

UK: In 2007 WRAP published a report prepared by Eunomia Research and Consulting that looked at the comparative costs and benefits, including monetised environmental costs and benefits, of different approaches to managing household bio-wastes (garden and food waste). The study looked at different collection and treatment systems including schemes in which food and garden wastes were collected separately from one another and schemes in which they were collected mixed. Different levels of home composting uptake and promotion were also considered in the various options examined.

The main finding was that **the design of the food collection system and the frequency with which the refuse is collected will influence the amount of material captured and will have implications for how it is treated, which in turn will impact on overall costs** and the diversion of material from the residual waste stream. In 2008 the research was updated to reflect changes in some of the underlying assumptions used in the original research such as gate fees and better data on operations of collections following the WRAP trials. The findings endorsed the earlier findings and strengthened the case for separate collections of food waste. The 2008 update to this research can be found at: [http://www.wrap.org.uk/downloads/Update to Biowaste CBA Report.e774d58d.6164.pdf](http://www.wrap.org.uk/downloads/Update%20to%20Biowaste%20CBA%20Report.e774d58d.6164.pdf)

The costs will always differ across different areas because of local variations. The costs should be used as indications and will vary depending on how well the services are delivered, received by residents, and local prices.

DE: See study *Cost analysis for the separate collection and treatment of bio-waste*, 2006. In summary one can say that at the present high price level for residual waste disposal in Germany, in most areas consequent separate **collection of bio-waste will lead to significant cost savings.**

FR: **Une étude comparant les coûts de traitement biologique (incluant la collecte) d'installations recevant des biodéchets triés à la source ou des déchets en mélange est en cours de lancement, mais ses premiers résultats ne seront disponibles que courant 2012.**

(A study comparing the costs of biological treatment installations (including collection), receiving bio-waste from source separation or from mixed waste is currently being launched, the first results will however only be available in 2012.)

LOCAL AND REGIONAL ADMINISTRATION

For the local and regional administrations, only COSLA referred to new evidence: a study conducted by SQW (see a short summary in chapter 4.3 of this report), mentions that the additional costs for separate collection might increase less than for other collection strategies, pointing however out that this would only be possible with a specific level of source separation which would not be attained with certainty. It also draws attention to the fact that the costs of education and awareness raising measures would also have to be taken into account. MWE states that costs for separate collection may be neutral, but that the costs for source or secondary separation (burdening households, businesses etc.) are not included. In the opinion of LGA however, separate collection targets would increase costs for local authorities. LGA fears that a reduced quantity of bio-waste that would feed into MBT could cause significant costs as they would make the plants less efficient.

COSLA:

Separate collection – barriers.

- a. The Scottish Government published a report undertaken by the consultants SQW examining the costs to local authorities of meeting EC and Scottish Government Waste targets. The report demonstrated that whichever strategy was pursued, the costs for waste collection authorities would significantly increase over the period to 2025 by between £1 – 1.5 billion over net present value. **Indeed from the purely quantitative analysis it does appear that whilst costs will rise with greater separate collection such projected increased will be not as great as for other collection strategies.**
- b. However, this conclusion is dependent on the successful implementation of a strategy based on significant separate collections. Again this significantly lower financial NPV cost is implicitly based on the assumed of high participation rates in food/bio waste collections which given the current Scottish evidence base shows is potentially difficult to assume with certainty. In addition it also could be argued that considering the avoidability of food waste greater emphasis should be placed on the producers, regulators and consumers of the food/bio waste to avoid presentation of waste in the first instance. This could be a further example of a separate collection target stimulating the collection/recycling of a waste type rather than being dealt with further up the waste hierarchy through waste prevention measures.
- c. The SQW report despite outlining the significant difference in economic costs concludes with a statement that clearly identifies a **significantly and potentially costly barrier to implementation: “If the EU and Scottish Government targets can be met with more source segregation and less residual**

processing [not including AD processing], **investment costs can be reduced through less need for MBTs as illustrated in Scenarios 4 and 5. The 60% and 65% source segregation of Scenario 4 and 5 both delay the need for infrastructure, particularly MBT, and allow more time to plan for and establish infrastructure. However, it may have to be considered whether these levels of source segregation are achievable and if so, whether any additional cost would be necessary, e.g. education and public awareness campaigns.**

- d. **Education and awareness measures will be an additional cost** which need to be factored into any econometric analysis of the costs delivering a waste strategy utilising significant greater proportions of separate collections.

Costs of separate collection.

At a Scottish local authority level, Glasgow and Clyde Valley shared service group set up to develop 'Clyde Valley Waste Management'. The initiative utilised 'low-level' local cost assessments for separate/co-mingled collection of bio-waste which is in complete contrast with the 'cost neutral' assumption - although COSLA is unsure whether the document has been published in the public domain or further work is required, it does provide potential further evidence for a lack of cost neutrality in some instances and the need for further micro scale evaluation of Macro-scale econometric analyses such as the aforementioned SQW report before further changes in policy are considered.

MWE:

Separate collection – barriers.

Cost for separate collection does not include the cost for source separation. The cost of the households, businesses and food processes or other sources of biodegradable waste, to provide the pre-treatment to facilitate separate collection is not included. Nor does it include the cost for space dedicated to separate collection, both in the private and public areas.

Costs of separate collection.

Costs for separate collection may be neutral, but the cost for source or secondary separation is not included. If a target only concerns bio-waste or even worse, only kitchen waste, the entire burden and cost for separation falls on individuals and households.

LGA: The potential cost of rolling out separate waste collection service for biowaste in every local authority area would be prohibitive. At a time of cuts in public services, councils will be forced to do more with less rather than expand existing arrangements. **Separate collection targets for biowaste would result in increased costs for local authorities having to introduce new waste management systems to meet these targets.**

Estimates of the cost of the introduction of new arrangements for biowaste from English local authorities range from a few hundred thousand to £1million in areas where they do not already collect biowaste. **New rules for mandatory separate collections would potentially penalise proactive councils which have already established their own arrangements and entered into long term waste management systems. Exiting PFI agreements or even amending existing contractual agreements with contractors will come at a significant financial cost running into the hundreds of thousands of pounds.**

Mechanical biological treatment (MBT) relies upon a minimum biodegradable waste level to operate effectively. **Its removal from the waste stream would cause significant financial costs for councils and the waste disposal authority, potentially rendering the plant redundant.**

Any new EU biowaste rules might radically change what constitutes the waste 'baseline' of a PFI contract. It could lead to large costs if waste arriving at sites fails to retain a minimum biological content. Any changes to PFI contracts in order to deal with the new EU conditions could cause difficulties either in exiting existing contracts or instigating 'change agreements' which would come with unknown associated legal fees and cost increases.

Heavy targets to avoid waste going to landfill are already imposed through the Landfill Directive and additional targets would simply impose new and unnecessary financial burdens on local authorities.

ENVIRONMENTAL AND CONSUMER ORGANISATIONS

Among the environmental and consumer organisations, AICA sees the costs of separate collection as neutral, while. In the same tenor, FNE + CNIID, basing themselves on a study conducted by the French ADEME (see short summary of the study in chapter 4.3 of this report), say that separate collection does not have to be more expensive overall (especially if the collection frequencies are optimised). Both CEEB and EEB criticise the inability to take advantage of cost savings by integrated collection (which can be due to a lack of knowledge on how to optimize collection).

AICA: AICA monitored the costs of more than 200 municipalities and in the majority of them, **the costs are neutral because the bio-waste collection costs are covered by the gain of reducing the frequency of residual waste collection; at the same, in the majority of cases, industrial composting is cheaper than landfill disposal.**

EEB:

Separate collection – barriers.

One important barrier to separate collection is the split in responsibility between collection and treatment. In France, for example, municipalities are responsible for collection, and another administrative level is responsible for treatment. Each level tries to optimize its own cost at the expenses of the overall management. The benefits of integrated management cost can not be realized.

Another barrier is the existing treatment facilities (incineration or MBT), which are the most cost effective options once the investments have been decided). Starting a separate collection may not bring any benefits if the subsequent treatment does not require it.

A third barrier is the lack of knowledge on how to optimize collection taking advantage of biowaste separate collection – or the remaining apriori that collecting separately is anyway most costly.

A fourth barrier is the a priori poor acceptability of the compost produced from household biowaste, resulting in resistance to start a separate collection.

An additional element, that is sometimes considered a barrier, is the so called reluctance by citizens to intensify further the sorting. EEB does not find any evidence of such reluctance if appropriate schemes are implemented and appropriate containers are provided.

According to EEB, the inability to take advantage of the integrated collection&treatment management cost is the strongest obstacle.

By setting legal drivers, the biowaste recycling targets will oblige to acknowledge the conditions and gain knowledge to an optimized management cost.

CEEB :

Separate collection – barriers.

The poor a priori acceptability of compost produced from household biowaste is considered a barrier, resulting in resistance to start separate collection. Such low acceptability could be interpreted as a lack of waste management economics knowledge.

The **inability to take advantage of the integrated collection and management treatment costs are strong obstacles**. By setting legal drivers, the biowaste recycling targets will oblige to acknowledge the conditions and gain knowledge to optimise management costs.

FNE + CNIID:

Separate collection – barriers.

The main barrier in France is the political posture of local authorities against the development of separate biowaste collection. This dogmatic position is based mainly on a fear of increasing costs, despite the **2008 ADEME study results which show that it is not necessarily more expensive overall. In order to introduce a new biowaste collection without increasing costs, it is often appropriate to reduce existing collection frequency**. This is possible since the residual waste no longer contains the smelly biodegradable waste. The collections need to be optimised with a global vision of streams. In France, the fact that often different structures are responsible for collection and for treatment of the waste does not facilitate a holistic approach or 'joined-up thinking'.

The allergy of French municipalities to separate biowaste collection is also based on a reluctance to overload their electors with too many obligations, and a conviction that people are incapable of such a complex sorting system. This is despite survey results showing that the majority of households are prepared to increase their sorting efforts. The prejudices held by the local authorities are very similar to those held before the sorting of packaging waste started in 1992; these proved quite unfounded.

In France the fact that MBT (mixed-waste composting) is still an option, and that the government despite not supporting this technology has not taken a clear enough stand against it, means that it appears (falsely) as a simpler answer for those collectivities not wishing to spend time and effort on educating their inhabitants. It is also encouraged by salesmen and by consultancies which receive a percentage of the costs of building the large and costly MBT plants.

Costs of separate collection.

A 2008 ADEME report: “Analyse technico-économique des opérations de gestion biologique des déchets”.

ACADEMIA

The only individual answering the questionnaire lists different factors increasing the costs of implementation of separate collection, food waste bins, liners (a burden for households or the Local Authorities), dedicated vehicles, staff training as well as communication programmes to raise awareness.

- **Professor Chris Coggins (CC)** - independent resource management consultant (Luton)

Handling and logistics

Households will need to store food waste in kitchen caddies (c. 5 litres), and if caddy bags/liners are used these will be an extra cost to the household and/or the collection operator. There is an ongoing debate as to whether caddy bags/liners should be provided by Local Authorities (as in various trials schemes) or have to be purchased by households, perhaps at discounted prices (typical web prices are £4.00 for 3, each lasting 3-4 months). There is also the debate about whether such caddy bags/liners are compostable (with EU/UK certification) or biodegradable such as starch or including bioplastic which require higher temperatures and longer retention times to break down.

Caddy liners may cause operational problems by blocking pipes and pumps.

A food waste bin (20-50 litres) for kerbside collection will add to the collection cost and number of waste bins for each household, together with dedicated collection vehicles and weekly collections, preferred to reduce odours and engage household participation. Staff training will be needed to check for contamination and liaison with households alongside a dedicated communications programme.

Some companies have introduced bespoke vehicles to collect food waste, with separate compartments for packaged and unpackaged (wet) food waste, leading to extra costs. On-farm AD facilities taking food waste from urban areas may increase traffic problems on narrow country lanes.

A 2009 report by the *Association of Public Service Excellence* quoted 90% of its 260 members collecting dry recyclables and green waste but only 23% collected food waste. The average participation rate was 66%, with wide variation, and an average of 1.9 kg collected per household per week.

Weekly collection of food waste may offset problems (odour and flies) with alternate weekly collection of residual waste, but will need additional vehicles and crews. The operation of the Biocycle/Greenfinch AD plant in Ludlow in South Shropshire (part of Defra's New Technology Demonstrator Programme) worked best with weekly collections of kitchen food waste, but in August 2010 South Shropshire District Council decided to stop collections in October 2010. Households will instead be encouraged to put food and cardboard into bins for garden waste. The council's waste contractor Veolia will send the material for in-vessel composting, as a more appropriate technology than AD as there will be more silt in the feedstock. The council says the move will save it £225,000 a year.

With the background financial squeeze and Coalition government plans to reduce public debt, cuts in Local Authority spending in the October 2010 Spending Review ranging from nearly 1% to 8.9%. Councils will face more challenges to reduce costs and this will affect service provision, both operational and facilities – a number of Councils are already planning to move to alternate weekly collections and comingled collections to save money, and some have also proposed closing civic amenity sites/Household Waste Recycling Centres (partly due to the wider introduction of kerbside collections).

Pressures on collection costs may also increase the potential for contamination, for both household and commercial sources of AD feedstocks.

Introduction of food collections will also require tailored communication programme(s), which will also cost money to implement

However, the move does not appear to make sense environmentally and can also be questioned economically. South Shropshire is collecting 2.17 kilograms of food waste per household per week under its existing collections, according to a report for the Waste and Resources Action Programme (WRAP) on

collections it helped finance. In contrast, fortnightly collections of mixed food and garden waste only get an average 0.55kg/hh/wk of food, according to other WRAP research. This is because householders find mixed collections confusing and are unwilling to leave food in bins for a fortnight.

INDUSTRY TRADE WASTE MANAGEMENT

One stakeholder (FNADE) also cites the previously mentioned ADEME study, deducing from it that it is difficult to assess the general cost as it will depend on local conditions and costs of treatments. WD mentions that studies have been conducted by some of their member companies on behalf of numerous municipalities, showing that the type of housing influences the costs associated with the introduction of separate collection of biowaste and that therefore the cost for marginal selection vary largely (from largely to marginal). ECN thinks that it is not the right way to have a look at mass related unit costs for separate collection as they do not demonstrate the effective cost savings of the entire waste collection scheme per household or inhabitant which can be achieved with the introduction of a separate collection. ECN also criticises the biased economic competition with biological treatment. AfOr refers to a study assessing the costs of separate food waste collection trial (see a short summary of the study in chapter 4.3 of this study). Insinkerator lists several additional elements required for separate collection (multiple bins, more frequent collections, adapted vehicles, awareness and education campaigns) which, according to them, cannot render separate collection cost-neutral. Novamont says that the need to invest in education and communication should not be underestimated. AS cites a Swedish report mentioning that households with separate collection of kitchen waste paid 11 % more (per year) for waste collection than household with mixed household waste. VKU states that separate collection and treatment of bio-waste is yet not possible in a cost-efficient way all over Germany, but depending on the local circumstances it can also be less expensive.

FNADE:

Costs of separate collection.

In France, separate collection of bio-waste is not established on the whole territory but only some local authorities chose to implement it. According to the conclusion of a 2008 ADEME's report (based on 2006 data), **the kind and the cost of treatment existing for biowaste streams and residual waste streams influence the financial balance of the overall waste management.** The report underlines that other factors have to be taken into consideration as the possibility for the cost structure of the overall waste management to absorb the additional costs (incurred by reorganisation of the collection and transfer of charges to one kind of treatment to another). The involvement of residents in the process is also important.

It is therefore **difficult to assess the general cost as it will depend on local conditions and costs of treatments.**

A specifically French phenomenon regarding the high density of civic amenity sites (1 for 15 000 inhabitants against 1/ 100 000 inhabitants in Germany) has a large impact on bio-waste collection. Most of the yard trimmings are brought directly within those facilities, so the door to door bio-waste collections are hardly over 50 kg/hab/year. Therefore, it becomes difficult to absorb any over-costs due to a dedicated bio-waste collection.

WD:

Separate collection – barriers.

Thorough studies conducted by some of our member companies on behalf of numerous municipalities show that the **type of housing** (apartment buildings, individual houses, summer houses, etc.) **influences the costs associated with the introduction of separate collection of biowaste. In some areas, the added costs related to separate collection may be considered as marginal; in other areas they are substantial.** Therefore, the assessment made by Eunomia and reflected in the present question that “separate collection should provide better waste management at comparable cost” is not valid in all cases.

Further to the economics mentioned above, some of the barriers to the introduction of separate collection schemes are:

- The physical limitations to the storage of multiple containers in specific housing types
- The adhesion of households to sorting at source determining the quantities being separately collected as well as the quality of the input materials delivered for treatment
- The climatic conditions influencing the collection frequency necessary for the hygienic management of biodegradable waste
- Some cities are equipped with a vacuum collection system that is not appropriate for separate collection of biowaste
- The switching costs

ECN:

Separate collection – barriers.

- 1) Existing contracts and traditional local networks of powerful waste companies with municipalities and regional administration
- 2) Lack of experience and knowledge about successful collection schemes (differentiated for household/commercial food waste, garden & park waste, industrial waste streams etc.), cost and fee structures, basic requirements about composting technologies, compost quality, use and markets in conjunction with insufficient infrastructure for biological treatment, missing reliable waste collection and waste sorting data
- 3) **Mass related unit costs for separate collection do not demonstrate the effective cost savings of the entire waste collection scheme per household or inhabitant which are achieved with the introduction of a separate collection** scheme for organic household waste e.g. by the resulting reduction and lower frequency of residual waste collection.
- 4) Misleading European funding programmes (cohesion/structural funds) which favour large scale and costly treatment (waste incineration, landfills, MBT) facilities
- 5) **Cheap / subsidised incineration and low dumping/landfill costs without environmental taxes and levies which do not reflect the entire external/environmental and post-care costs. Creates biased economic competition with biological treatment.**
- 6) Contracting schemes which leave the collection and treatment framework to pure market forces - only economical and no ecological criteria.
- 7) Biased permits/licensing requirements for biological treatment plants which increase infrastructure costs to unnecessary high levels

8) Insufficient budget for awareness rising, information and education of the households. We need to change the day-to-day behaviour of the population which needs a lot of efforts.

Costs of separate collection.

Coll i Gelabert, E.; Giró i Fontanals, F. et al (2008) Manual Municipal de Recollida selectiva a Porta a Porta a Catalunya (Manual for Municipalities about the source separated door-to-door collection in Catalunya, Spain), downloadable pdf at www.portaaporta.cat (in Catalan language)

AfOR:

Separate collection – barriers.

- Cost of collection: new bins for residents, available money covering the additional waste stream, proximity principle, vehicles (additional, retrofitting, fuel)
- Currently the UK is under very tight financial constraints particularly within local Government. With reduced budgets certain activities including biowaste collection could be affected.
- Access to treatment facilities: currently not all areas within the UK supported (lead in times for development of additional facilities required). In order for new facilities to be built, there needs to be market confidence to underpin future investment in the sector.
- Existing contracts between waste collection and disposal authorities (if a two tier authority).
- Supply of information to the public can be costly but is a requirement for successful and continuing participation

Costs of separate collection.

- The following reports provide evidence
- Food Waste Collection: Update to WRAP Biowaste Cost Benefit Study
- http://www.wrap.org.uk/downloads/Update_to_Biowaste_CBA_Report.67a8cd45.6164.pdf
- Evaluation of the WRAP Separate Food Waste Collection Trials
- http://www.wrap.org.uk/downloads/Evaluation_of_the_WRAP_FW_Collection_Trials_Update_June_2009.224aecff.7271.pdf
- Waste and Resources Assessment Tool for the Environment (WRATE)

<http://www.environment-agency.gov.uk/research/commercial/102922.aspx>

INSINKERATOR:

Separate collection – barriers.

Separate collection is more expensive than mixed collection. Multiple bins are required, more frequent collections might be needed and special vehicles might be needed. Landfilling is often

relatively inexpensive unless there is tax. Some citizens resent having to store food waste separately, many will only participate if there is draconian enforcement, which politicians may be unwilling to implement because it is unpopular. On the other hand, FWD separates this most difficult fraction (food waste) conveniently, hygienically and without odour. They have been shown to improve the yield of other recyclables. The introduction of separate collection should only be based on the conclusions of an impact assessment showing that this option is likely to achieve the highest recycling rate in a sustainable manner.

Costs of separate collection.

Separate collection involves additional bins and additional or adapted vehicles and to be successful involves intensive and continuing citizen awareness and education campaigns. It is therefore very unlikely ever to be cost-neutral.

Novamont:

Separate collection – barriers.

- Lack of strategic, integrated waste management planning, both at national and local level;
- Uncertain legislative framework;
- Waste management costs are still largely externalized;
- Competition by subsidies diverting bio-waste towards other – less environmentally sound - waste management methods;
- Existence of other waste treatment and disposal infrastructures freezing the development of the most effective and efficient collection and treatment option (e.g. already existing low cost landfills or excessive incineration capacity);
- **Lack of knowledge and experience on the benefits of composting by decision-makers and operators.**
- **This, among others, reinforce the myth that separate collection is always more costly than other options.**
- **Lack of trust in the willingness and ability of citizens in participating in the separate collection schemes. This is often coupled with the under-rating of the need to invest in education and communication.**

DAKOFA:

The latest Danish costs assessments referring to separate collection are stated below (not available in English/and or not directly related to costs):

- "Plan for behandling af organisk affald" med tilhørende notat. Trekantsområdets affaldsselskaber I/S, 2008. Attached.
- "Miljøøkonomisk undersøgelse i Holbæk, Kalundborg og Odsherreds Kommuner – todelt dagrenovationsindsamling". Rambøll for Kara/Noveren 2007. Attached.
- "Kombineret bioforgasning og kompostering af kildesorteret organisk dagrenovation i batch-anlæg". Miljøprojekt nr. 1002, Miljøstyrelsen 2005.

- <http://www2.mst.dk/udgiv/publikationer/2005/87-7614-610-3/pdf/87-7614-611-1.pdf>
- “Skal husholdningernes madaffald brændes eller genanvendes?”. Samfundsøkonomisk analyse af øget genanvendelse af organisk dagrenovation, Miljøprojekt nr. 814, Miljøstyrelsen 2003.
- <http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/Udgiv/publikationer/2003/87-7972-685-2/html/helepubl.htm>

AS:

One report from Swedish Waste Management about waste fee for 2009 showed that household with separate collection of kitchen waste (food waste) paid 11 % more (per year) for waste collection, than household with mixed household waste. The report can be found here (in Swedish): <http://www.avfallsverige.se/fileadmin/uploads/Rapporter/Utveckling/U2010-09.pdf>

VKU:

Separate collection – barriers

Derzeit ist die getrennte Sammlung und Verwertung von biologisch abbaubaren Abfällen, speziell Bioabfällen, in Deutschland nicht kostendeckend möglich. Abhängig von den örtlichen Bedingungen kann das gesamte System der Abfallbewirtschaftung mit getrennter Sammlung des Bioabfalls jedoch kostengünstiger sein als ohne.

(Separate collection and treatment of bio-waste is yet not possible in a cost-efficient way in Germany. Depending on the local circumstances, the whole waste system with separate collection of bio-waste can be less expensive than without separate collection.)

CIWM: CIWM is aware that collection methods in place need to be assessed fully, not just as they operate currently but how they may have to change to incorporate new collection schemes, or extended collection schemes for biowaste.

12) Other effects. Can you think of any possible effects of setting bio-waste recycling/separate collection targets at the EU level that have not been discussed in the ARCADIS/Eunomia study, e.g. effects on employment for low-skilled workers, administrative costs of managing a separate collection system, competitiveness, etc?

This question has generated very few answers, most of them covering topics also discussed in the responses to previous questions:

- The bio-waste recycling industry is a regionally embedded infrastructure, which provides jobs to low-skilled and medium-skilled workers in the regions where waste is being generated. Hence, this might create more employment as compared to the treatment of mixed waste in large centralized installations and contributes to the socio-economic benefits of the waste industry. (BVOR, ES)
- EEB adds that involving local farmers in composting facilities may provide a complementary revenue and ease the acceptability of compost.

- MWE states that all treatable organic waste, also from non-municipal origins, should be included when assessing the potential of different treatment technologies. It must also be kept in mind who will face the responsibility when a specific target is set: if only kitchen waste is considered, the responsibility entirely belongs to individuals and market functioning is not taken into account.
- BDE and DS emphasise the future agricultural need for carbon and fertilizer, especially phosphorous, as a consequence of climate change, fertilizer scarcity and increasing prices as well as an increasing focus on ecological farming. BDE adds that besides a target for separate collection, it might be useful to set a target for phosphorous recycling, cf. the renewable energy target.
- DS states that an assessment of interactions between different EU directives and regulations needs to be carried out.
- FNADE points to the complexity of separate collection. An exhaustive study on the technical, economical and practical pros and cons of separate collection, throughout the EU should be is deemed necessary.
- Insinkerator stresses the difficulty of accurately measuring the accomplishment of bio-waste recycling targets. This is expected to be expensive, subject to sampling errors and have health implications. Obliging a landfill tax does not require such difficult and expensive measurements and is believed to be an effective measure to implementing the most optimal diversion strategy for local circumstances. According to Insinkerator, some allowance would have to be made for the quantity of bio-waste per FWD if there were to be bio-waste recycling/collection targets.
- AfOR adds that a robust recording scheme would need to be adopted or included in the existing methods.
- CIWM claims that without incentive the most economically optimal solutions will be chosen and many Member States are not likely to embrace bio-waste processing.
- GAIA believes that little attention has been paid to positive externalities of bio-waste treatment such as cleaner collection of other fractions, which would lower the costs for preparation for recycling and increase the quality of the recycled materials.

ANNEX B: MINUTES OF THE WORKSHOP ON BIO-WASTE RECYCLING, DG ENVIRONMENT, 07/03/2011

8.3 WORKSHOP

8.3.1 NON-EC ATTENDEES

Jacques	Hoffenberg	Waste Denmark Belgium
Inge	Werther	DAKOFA
John	O'Neill	Environment inspectorate Dublin
Esther	Goidts	DG Agriculture, Natural Resources and Environment Public Administration of Wallonia
Phillipe	Decornet	DG Agriculture, Natural Resources and Environment Public Administration of Wallonia
Darren	Cordina	Malta Environment and Planning Authority
Stefanie	Budewig	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Verena	Klinger-Dering	Environment Attaché- Permanent Representation of Germany
Linda	Bagge	Danish Ministry of the Environment
Joan	Simon	Global Alliance for Ininerator Alternatives (gaia)
Angeliki	Malizou	European Environmental Bureau
Helene	Bourges	CNIDD
Hannele	Häkkinen	The Association of Finnish Local and Regional Authorities
Marie	Bullet	Council of European Municipalities and Regions
Serafin	Pazos-Vidal	Convention of Scottish Local Authorities (COSLA)
Ana	Rodriguez Cruz	Ministerio de Medio Ambiente y Medio Rural y Marino
Laetitia	Reynaud	FEAD
Kinga	Majewska	Ministry of Environment Poland
Justyna	Kuźniar	Ministry of Environment Poland
Teresa	Guerrero	Waste Agency of Catalonia
Pat	Fenton	Dublin, Department of the Environment , Heritage and Local Government
Nienke	Smeets	Dutch Permanent Representation to the EU Environment and Nature Department
Annemie	Andries	OVAM
Florian	Amlinger	European Compost Network
Catarina	Östlund	Swedish Environment Protection Agency
Peeter	Eek	Ministry of the Environment Estonia
Grigor	Stoyanov	Ministry of Environment and Water of Bulgaria
Francesc	Giró	Cataluña

Angelika	Blom	Municipal Waste Europe
Marida	Di Girolamo	Municipal Waste Europe
Susana	Lopes	Serviço Intermunicipalizado de Gestão de Resíduos do Grande Porto
Yves	Decelle	FEAD
Thomas	Bonhoure	French Government - Developpement Durable
Paul	Stansfield	UK Government - Carbon Budget & EU waste policy
Laurent	Franckx	VITO
Katrijn	Alaerts	VITO
Stella	Vanassche	VITO

8.3.2 WORKSHOP PROGRAMME

09:30-10:00: registration

10:00-11:15: first session

- Bartosz Zambrzycki (European Commission, DG Environment): Assessment of feasibility of setting bio-waste recycling targets in EU – background
- Laurent Franckx (VITO): Summary of the findings of the stakeholder consultation and revised policy scenarios

11:15-11:35: coffee break

11:35-12:50: second session

- Florian Amlinger (European Compost Network): Approaches for quality based biowaste recycling in European legislation
- Simon Lundeborg (Klimatbyran, Sweden): Swedish experiences of targets and drivers for biowaste recycling in relation to possible problems of implementing an EU-target for biowaste.
- Peeter Eek (Ministry of the Environment, Estonia): Achievements and challenges with bio-waste - Estonian experience
- Grigor Stoyanov (Ministry of Environment and Water, Bulgaria): Biowaste management in Bulgaria - current situation and future challenges

12:50-13:50: lunch break

13:50-15:05: third session:

- Francesc Giró (ACR+): Strategies and Experience on Biowaste Management in Catalonia
- Angelika Blom on behalf of Gunnel Klingberg (Municipal waste Europe): Suitable waste management of biodegradable waste.
- Susana Lopes (Serviço Intermunicipalizado de Gestão de Resíduos do Grande Porto) : Biowaste strategy. The importance of selective collection.
- Yves Decelle (FEAD) : Industry's views on EU biowaste recycling targets

15:05-15:25: coffee break

15:25-16:40: fourth session

- Ella Stengler (Confederation of European Waste-to-Energy Plants): bio-waste recycling complementary with waste-to-energy?
- Panel discussion with the invited speakers (moderation: Laurent Franckx, VITO)

16:40-17:00: conclusions: Laurent Franckx (VITO)

8.3.3 PRESENTATIONS

All presentations can be found on CIRCA: http://circa.europa.eu/Public/irc/env/biowaste_prop/library?l=/consultations_2010-jan/summary_workshop&vm=detailed&sb=Title

The main message of each presentation and any additional information, not contained in the above mentioned .ppt files, is summarized below.

First Session

Introduction – Bartosz Zambrzycki, EC

Clarification of the background for the current workshop and the future (legislative) steps to take.

The latest EC documents on the bio-waste subject were published on 18 May 2010: (1) the Communication from the Commission on future steps in bio-waste management in the European Union COM(2010)235 final and (2) the accompanying Commission Staff Working Document SEC(2010) 577 final. Conclusion: more work is needed from the subsidiarity perspective before considering whether to propose an EU target for biological treatment.

Issues to be clarified:

- Problems with implementation of current legislation: possible reasons – differences between MS: why do some MS experience such problems, while others don't.
- Subsidiarity: why would the EU-level better be suited for target setting – feasibility of a range of targets for different MS
- Cost and optimization: a better justification of the assumption of 'no additional cost for separate collection' is needed – is 36.5% the optimal level for an EU-level bio-waste treatment target?
- Factors affecting separate collection/recycling of bio-waste

The previous study of Arcadis/Eunomia formed the basis for the stakeholder consultation. The aim of the new study was to improve the dataset used in the Arcadis/Eunomia study and address the issues above, mainly based on the information obtained from the stakeholder consultation.

The MS response to the consultation was somewhat disappointing: only 9 MS and Norway replied. AT and BE responses are not (yet) included in the analysis of the draft report since they were only recently received. If still possible, they will be taken into account in the final report.

Most interesting (verifiable) data was provided by organizations from the industry, waste management & trade category. On the whole, mainly political statements were made. The local authorities above all stress the importance of addressing bio-waste issues at the local level: 4 out of 5 responding authorities is opposed to an EU-level bio-waste target.

Further steps:

- A new study, focusing on targets only, is ongoing
- A new impact assessment is in preparation
- If targets are justified by the IA, they will be introduced by means of a modification to the WFD (Art 11.4) somewhere between 2012 – 2014, most probably by 2014 (final deadline for decision, revision of the WFD)

Other activities:

- LCA guidelines for bio-waste management will be published in 2011
- A study on EoW criteria for biodegradable waste is ongoing. The report is expected in 2011.

Preliminary results of the current study – Laurent Franckx, VITO

The Arcadis/Eunomia analysis was reiterated with new data: readily available data at EU level and some data from the stakeholder consultation. Information obtained during this seminar will also be included.

New projections for waste generation were constructed, based on:

- changed mass flows for 8 MS, mainly thanks to stakeholder consultation data
- new economic and demographic forecasts
- a revised functional relationship between macro-economic indicators and waste generation: based on 3 different papers – the most robust result at EU level was used: a high level of relative decoupling, no absolute decoupling. This will probably not be the best estimate for all individual MS.

The Arcadis/Eunomia study assumed that separate collection does not entail additional costs 'if optimised'. Optimization is of utmost importance when comparing collection systems, but very little detailed information was received on the matter. The stakeholder consultation did not provide much additional information, but the results of some studies demonstrate that findings on separate collection costs cannot easily be generalized. The assumption of the Arcadis/Eunomia study was not altered in the analysis.

The main barriers identified in the stakeholder consultation are:

- Knowledge issues: this demonstrates the need for EU-level efforts on information exchange.
- Existing installations: adequate transition periods are clearly required, but this issue will not last in time.
- Costs: it is often unclear whether the issues raised are based on assumptions/opinions or represent true practical experiences.
- Political barriers: very much related to the above issues
- Logistical issues

Some conclusions on the reported advantages and disadvantages of target setting:

- There were a number of misunderstandings as regards the scope of the proposed target e.g. some stakeholders seem to assume that a mandatory target will be set at the municipal level, others suppose that home composting is not accounted for etc. A clear communication is needed.
- Local flexibility is considered very important by almost all stakeholders.
- Attention should be paid to the accommodation of new recycling technologies in the target.
- Impact on prevention (e.g. green waste mobilization) could be limited if home composting were included in the target.
- Any target setting should try to limit the associated administrative burden.

New baseline scenario:

- 4-fold increase in backyard composting due to revised figures in three MS: this demonstrates a need for good quality data, the home composting amounts are probably much higher, but not known.
- The baseline is more favourable than in the Arcadis/Eunomia study, but estimates are very uncertain. Better standardized reporting is needed for quality estimates to be made. Good projections should be based on household-level data instead of on macro-economic indicators.

Effect of the targets:

- Target 1 (60% food waste and 90% garden waste capture by 2020): the economic benefits decreased from 7 billion (Arcadis/Eunomia study) to 3 billion euro. This can largely be explained by the removal of the prevention effect. Environmental benefits become relatively more important than financial benefits.
- Target 2 (36.5% separate collection by 2020): less economic benefits, but the same conclusions hold.
- The magnitude of benefits are affected by the baseline changes, but not the qualitative conclusions of the Arcadis/Eunomia study.

Discussion:

- The removal of the prevention effect from the policy scenarios (7.5% in the previous study) does not mean that prevention will be abandoned as a policy measure. A parallel process investigating only prevention is ongoing. (*Bartosz Zambrzicky (BZa), EC*)
- The difference between the conclusions of the Arcadis/Eunomia study and the current study on the target 1 scenario amounts to about 4 billion euro. This demonstrates among others the importance of good quality data to obtain quality results. But what would it take to have a 0 result, no benefit at all (*Jaques Hoffenberg (JHo), Waste Denmark*)? The magnitude of the benefit clearly depends on the data used in the baseline, but a 0 result would mean that the policy scenario would not bring about any changes to the current and expected practices, which is unlikely. (*Laurent Franckx (LFr), VITO*)
- EoW criteria could be used for defining recycling. The level of the targets could be adjusted to these EoW criteria e.g. a low target for high quality recycling or a high target for whatever is considered recycling. (*BZa*)
- The 36.5 % target is based on EU-level data on the separate collection of bio-waste. AD as well as composting are considered recycling, on the condition that digestate/compost is used on the field. Not only end-of-waste status compost/digestate is thus included. Numerator of the target: bio-waste (green + kitchen) to home composting, AD or composting, denominator: the amount of bio-waste in municipal waste. (*LFr*)
- Industrial bio-waste is not included in the target, since data availability is very limited. Even for MSW, data collection was not always straightforward due to differences between MS definitions and inconsistencies between data from Eurostat, data at national level and data obtained from different ministries. (*LFr*)

Second session

Approaches for quality based bio-waste recycling in European legislation - Florian Amlinger, ECN

Main motivation and drivers for bio-waste recycling/treatment:

- Of the 4 main bio-waste treatment options (composting, AD, MBT, incineration), only composting and AD bring quality C back to the soil. Mature compost has a very high humus (stable C) content as compared to e.g. straw, sludge, digestate and green manure.
- Currently only about 30% of a realistic EU potential for bio-waste recycling is source separated.
- The introduction of bio-waste separate collection leads to a quick increase in bio-waste recycling amounts and fulfillment of the landfill diversion targets.
- Not only reducing the amount of bio-waste sent to landfill, but also the creation of a useful product, satisfying the market needs is an important benefit of bio-waste recycling. Quality matters for ensuring a well-functioning compost market. The use of compost produced from not separately collected bio-waste leads to a higher accumulation of heavy metals in the soil.
- Compost contains important plant nutrients, which is an especially interesting characteristic since prices of nutrients (e.g. phosphorous) increase and will keep on increasing.
- The fear that separate bio-waste collection would increase waste treatment costs is unfounded in many cases: in most situations the introduction of separate bio-waste collection is cost neutral or price savings occur. Of course this depends on the costs of landfilling (landfill taxes). In the examples provided it is supposed that landfilling is about twice as expensive as biological treatment.

Remark: home composting should be excluded from the recycling target, because home composted amounts are very difficult to calculate on a scientific basis. MS might easily reach the recycling targets just by increasing their figures on home composting and this can hardly be verified.

Swedish experiences of targets and drivers for biowaste recycling in relation to possible problems of implementing an EU-target for biowaste - Simon Lundeborg, SE

In SE several drivers have been introduced for increasing bio-waste recycling: investment grants, landfill taxes, a landfill ban, environmental labeling of compost/digestate, a tax exemption for biogas as a vehicle fuel, national recycling targets and a tax on MSW incineration (the latter only lasted for three years). The MSW food waste recycling target (35%) is quite parallel to the proposed EU-level bio-waste target and has not yet been reached, but will probably be met by 2013.

Best practice example: a cooperation between 12 municipalities for separate collection and AD treatment of MSW bio-waste. A thorough MSW composition analysis was carried out. An 80% kitchen waste recycling rate was reached at household level.

Garden waste is collected at civic amenity sites. Close to 100% used to be recycled, now a part is used for compost production and another part is incinerated as a bio-fuel.

In SE the costs of bio-waste incineration, AD or composting are about the same, the economical discussion therefore mainly concerns the collection costs.

It is confirmed by municipalities that the national recycling targets act as an important driver. The good examples of some municipalities have an important impact on other municipalities. The municipalities which first introduce separate collection are not the ones owning incinerators. In these municipalities economic conflicts between bio-waste recycling and incineration exist. Waste is already imported from NO to be incinerated. Gate fees for incineration are low. Future conflicts between biological treatment and incineration of a part of the collected garden waste are expected.

Apart from recycling targets, marketing and economic drivers are crucial for stimulating bio-waste recycling. The national level should provide support to the municipalities for investing in biological treatment facilities.

Achievement and challenges with bio-waste - Peter Eek, EE

In EE, municipalities are obliged to set up MSW collection schemes, but are not financially supported by the national level. As such, they are mostly dependent on market conditions for increasing bio-waste recycling. Private firms are responsible for municipal waste collection and treatment. Contracting is organized by means of a tender system, which includes terms for source separation. Municipalities do not have the right to decide on how waste is to be treated. This makes it difficult to set up bio-waste recycling systems.

MSW recycling receives little attention, since MSW constitutes only 3% of the total waste generated (72 % arises from oil shale mining and energy production). It is however the main contributor to bio-waste generation: about 65 % of MSW is biodegradable waste. An MSW sorting study demonstrated that about 30% of the MSW is kitchen waste, 5% is garden waste. Only 10% of the kitchen waste is separately collected at present.

About 20% of the population has no access to waste collection. This results in illegal waste dumping. Discussions on the cost of household waste management and the advantages and disadvantages of flat fees vs. PAYT schemes are ongoing. Many householders believe that they are not generating enough waste for participating in separate collection schemes.

Based on the current waste treatment levels and capacities it is clear that separate collection and biological treatment alone will not suffice for reaching the Landfill Directive targets. Also MBT and incineration will be needed. Landfill capacity is adapted to the current landfill levels, but will be over dimensioned when the Landfill Directive targets are met. Anyhow, plans to build a 6th landfill are on their way and receive political support. The establishment/development of landfills is supported by means of national as well as EU funding. Landfills are developing towards more recycling and recovery operations.

On the whole, there is a clear overcapacity of bio-waste treatment options. Landfill taxes are increasing. This makes incineration a cheaper option than landfilling, which leads to reducing the amounts of bio-waste going to landfills. The introduction of a tax on incineration/MBT will be needed in order to further stimulate bio-waste recycling. The current quality of bio-waste for composting is highly variable and in some cases really low. Awareness-raising campaigns and supervision are needed.

If bio-waste recycling/separate collection targets are set, clear guidelines are needed for reporting as well as for carrying out MSW sorting analyses.

Discussion

Should a target include home composting or not?

- It is very difficult to obtain quality data on home composting. Therefore, it would be best not to ask for figures at EU-level and count home composting as a prevention measure. At the same time MS could be obliged to implement home composting programmes. (*Florian Amlinger (FAm) –ECN*)
- Legally, home composting is not a prevention measure, since the waste is already generated. But in any case it is difficult to find a good solution: excluding it from the target will discourage home composting, including it will result in difficulties for data gathering. (*BZa*)
- Education on quality home composting is crucial. Home composting will not be discouraged by excluding it from the recycling target, since quality home composting is a commitment: the families that currently have a well-maintained home composting facility (about 5 %) will not stop this activity because of a recycling target being set. (*FAm*)
- Only very few data on home composting were received and could be used for the modeling exercise. These data only concern quantities, nothing is said about the quality of the composting process. (*LFr*)

Bio-waste management in Bulgaria, current situation and future challenges - Grigor Stoyanov, BG

Various measures have been and will be taken to improve bio-waste recycling.

According to the national waste management plan, municipalities are responsible for the waste management on their territory.

A Landfill tax applies to all recoverable waste. At present, this tax is very low since infrastructure needs to be put in place, but a fast increase is planned (1.5 euro/tonne in 2011 to 17,5 euro/tonne in 2014 for MSW). The tax will be doubled for municipal landfills not meeting the requirements of national legislation.

Landfill diversion targets are laid down in the national strategic plan for diversion of biodegradable waste going to landfill. Composting will be the main treatment method for bio-waste. The strategic plan foresees to start off with the construction of composting sites in each municipality, the separate collection of green waste and the stimulation of home composting. Later on separate collection of food waste will be introduced.

3 types of areas are distinguished as regards bio-waste management opportunities:

- 1) Cities: no separate collection will be introduced, since this is considered difficult. Green waste will be collected in civic amenity sites.
- 2) Towns: excellent characteristics for introducing separate collection
- 3) Villages: no need for separate collection, since villagers take care of their own bio-waste. Information campaigns on home composting will be launched.

The construction of 2 MBT-plants with a composting site and 36 composting plants is planned. However, funding is needed for these investments as well as for the closure of old municipal landfill sites, since costs would amount to about 340 million euro.

The ECN compost quality manual has been translated into BG language. Further steps will be taken to stimulate (quality) composting: an ordinance on separate collection and management of organic waste, a compost ordinance, good practice guidelines, NQAS, etc.

Third session

Strategies and experiences in bio-waste management in Catalonia - Francesc Giró, ARC

ES is responsible for the transposition of the WFD, the Autonomous Communities (such as Catalonia) for the waste management. Catalonia is the only AC that has introduced a separate collection/recycling target for bio-waste.

Catalonia has large areas with a low soil organic matter content. Desertification risks are high throughout ES. Increased bio-waste recycling could improve this situation. Furthermore, a reduction of greenhouse gas emissions, savings due to the replacement of fertilizers and energy savings (in case of AD) are to be expected.

Kitchen waste represents about 36 % of the generated MSW, other recyclables (glass, paper and light packaging waste) cover 37 %. It will therefore be very difficult to reach the general WFD and Landfill Directive targets without the introduction of separate bio-waste collection systems.

Catalonian experience shows that a mix of instruments is needed for optimizing separate collection: a combination of legislative mandates, targets, economic incentives as well as infrastructure planning and technical assistance to local authorities is crucial. E.g. :

- Catalonia started with the introduction of a separate collection target when the capacity of the composting plants was still insufficient. This created an economic imbalance at the time.
- Waste management statistics show that only when a tax on landfilling and incineration, tax refund criteria and subsidies for promoting bio-waste separate collection were introduced, a true increase in bio-waste recycling took place.

Separate collection systems can and need to be adapted to different local circumstances (among others low vs. high population density) in order to optimize the results and avoid the increase of collection costs. Quantity as well as quality of the separately collected bio-waste in Catalonia has improved through the years. The amount of impurities (plastics, metals, etc.) however, is still quite high (about 10 %). Tax refund criteria were introduced to stimulate quality recycling: a multiplication factor depends on the amount of impurities present.

Different quality requirements were set for compost for agricultural uses vs. stabilized bio-waste originating from mixed waste collection. The latter can only be used for non-agricultural purposes. Such quality criteria are necessary for successful recycling and market development.

Suitable waste management of biodegradable waste - Angelika Blom, Municipal Waste Europe

First of all, a clear definition of the subject of any recycling target is needed: bio-waste as defined in the WFD or biodegradable waste as defined in the Landfill Directive?

The Landfill Directive and the WFD already provide for sufficient incentives to divert bio-waste away from landfills and deliver the best environmental outcomes.

Lots of aspects determine the best waste treatment option for a certain locality. Therefore, flexibility to adapt the waste management system to the local circumstances is needed. Imposing one set of technical conditions can limit further technical development. Furthermore, one quality system cannot fit all.

Conclusion: the measures are already in place. We do not need more legislation, but more action.

Question

Who will need to take this action then? Where is the action lacking? (BZa) We all need to take action, but we better discuss this later on. (Angelika Blom (ABI), MWE)

Biowaste strategy, the importance of selective collection - Susana Lopes, LIPOR

General remarks:

- The Porto region has a high population density, leading to specific waste collection issues.
- Bio-waste prevention is stimulated. Home composting is included as a prevention measure.
- Soil organic matter content is low, so the application of compost could contribute to improving this situation. Compost quality is therefore considered crucial.

- The main issue for PT is the need to comply with EU legislation. In order to reach the EU targets, the Portuguese government plans to focus on building new MBT installations. However, MBT compost quality is not considered good enough to be used on agricultural soils. An EU-level separate collection target would help overcome this issue.

The LIPOR approach for stimulating bio-waste recycling:

A composting plant (in vessel, tunnel system) was constructed in 2005 and selective collection of bio-waste was implemented in 2005. Additionally, a marketing strategy for compost was adopted and information campaigns were launched. Currently, selective collection is organized only for restaurants and canteens as well as for large producers. Besides, a yearly amount of 3500 tonnes of flowers is collected from cemeteries.

Restaurants and canteens are very satisfied with the current bio-waste collection system. It is believed to provide a better 'sustainable' image to restaurants. Very high amounts of food waste are collected: about 30 kg/establishment/day. The associated collection costs are high, since a high collection frequency is needed owing to the warm climate (3 to 7 times a week). Information campaigns are crucial. A similar bio-waste collection programme was set up for large producers.

Separate bio-waste collection for households is expected to be introduced in 2011. An experiment with household waste collection in 2006 did not deliver good results. Bio-waste was collected in plastic bags, which led to quality problems at the composting installation. The results of recent awareness-raising campaigns and enquiries were disappointing: 50% of the population does not recognize the advantages of participating in separate collection schemes. As PAYT-schemes are absent, no real financial incentives exist for participation. In addition, due to the high temperatures, citizens would like to see a daily collection of bio-wastes, which would mean a steep increase in collection costs. The willingness to participate in separate collection systems poses an important constraint to establishing separate bio-waste collection schemes for households. Again, it appears that information campaigns are crucial.

All compost produced so far meets the quality criteria for organic farming. It is very important to keep this quality high, when including MSW bio-waste. Therefore, it is considered that source separation is needed (which is against the opinion of the Portuguese government).

Industry's views on EU bio-waste recycling targets - Yves Decelles, FEAD

FEAD represents a wide range of waste management associations and companies, covering composting, waste recycling and sorting, landfill as well as waste-to-energy activities. All members are in favour of stimulating bio-waste recycling.

The current EU legislative framework is not efficient enough for pushing bio-waste recycling: the Landfill Directive diverts biodegradable waste from landfill, but does not direct it towards recycling, Art 22 of the WFD is not legally binding and Art. 11 is unclear since it has 4 different interpretations.

While energy can be generated in many different ways, this is not the case for nutrient resources: if they are finished we will not be able to replace them. An EU initiative on bio-waste could have many environmental, as well as economical and legislative benefits. Legislative push mechanisms (bio-waste targets), should complement market pull mechanisms (EoW criteria). However, any target needs to be accompanied by appropriate legal guidance. Prior to setting a recycling target, the definition of recycling has to be clarified. This definition should not be limited to EoW criteria only. Differences in the chemical analysis methods used can already lead to very different interpretations.

Since current recycling levels vary widely between EU MS, differentiated target setting is favoured. MS should be able to choose from a range of possible methods to calculate the target which is best adapted to their situation. E.g. for MS with currently well-established separate collection schemes a target in kg/capita.year of bio-waste separately collected could be feasible, while for other MS it would be easier to calculate a target specified as kg/capita.year of compost or digestate produced and recycled on land.

Another interesting possibility, positively addressing the need to protect soils and to recycle the limited nutrient resources, could be to formulate a target as the minimum renewable/recyclable content of fertilizers or growing media.

MS should be able to demonstrate that they are making progress in bio-waste recycling over time.

Discussion

- The position of FEAD members on whether or not separate collection should be a prerequisite of bio-waste recycling differs. Especially the French members advocate recycling without the need for separate collection. They consider that the compost produced by new MBT plants has a higher quality than before and can be used for various purposes. (*YDe*)
- Calculating a target based on the recyclable content of e.g. fertilizers seems difficult, since many substances are imported. (*FAm*) *YDe* agrees that it might not be easy, but the implementation of REACH shows that taking account of imported substances can be feasible.

Fourth session

Bio-waste recycling complementary to Waste-to-Energy? - Ella Stengler, CEWEP

Different examples show that waste incineration can go hand in hand with bio-waste recycling:

- BE shows a high rate of quality bio-waste recycling. 11 out of 15 WtE plants also exploit a composting plant for Vegetable Fruit and Garden (VFG) waste or green waste.
- NL has the highest performance of separate bio-waste collection (in kg per capita) in the EU. The Dutch Association of Waste Companies (Vereniging Afvalbedrijven) states that source separation helps WtE plants to perform better, since the wet content of bio-waste reduces the energy efficiency of the incineration process. In several locations composting plants and WtE plants are located on the same site. National legislation lays down material recycling as a minimum requirement for source separated VFG-waste.
- Also DE has a very high bio-waste recycling rate. In DE some waste treatment centres combine sorting plants, composting plants, fermentation plants, WtE plants and/or landfills. Separately collected bio-waste that is not clean enough goes to WtE. A study in Bavaria shows that synergies can be created by integrating fermentation plants in WtE plants: GHG emissions and costs can be significantly reduced as compared to stand-alone AD plants.

Conclusion: while respecting the waste hierarchy, WtE can be an ideal solution for the remaining waste. It provides a locally available effective way for energy production. E.g. in Copenhagen 30% of the heat demand in district heating systems is provided by WtE plants.

It is of utmost importance to reduce MSW going to landfill. Landfill Directive enforcement is therefore indispensable ('low hanging fruit').

A scenario projection of the contribution of WtE to sustainable energy production was carried out. In this projection, it is among others assumed that energy efficiency of the plants will improve and that at least 50 % the waste generated will be recycled. The potential amount of energy generated by WtE plants by 2020 would be enough to supply 45 million inhabitants with electricity and 24 million inhabitants with heat.

Clean bio-waste collection combined with WtE conversion of the residual waste (which is not clean enough) is sustainable, since it contributes to both food and energy production.

Discussion

- CEWEP supports source separation and quality recycling, but is not especially in favour of, nor against a bio-waste recycling target at EU level. Differentiation and adaptation to local circumstances is necessary. (*ESt*)
- Standards are needed to determine quality recycling. (*Linda Bagge, DK*)

- Waste with a low calorific value should not be taken into account in the R1-formula for calculating the energy efficiency of an incineration plant. (*FAm*) The issue has been discussed previously, but appears very difficult to realize in practice. (*ESt*)
- The economic environment (subsidies, taxes, funding) does not reflect the environmental costs of the different waste treatment options, e.g. EU funding for incineration plant construction. (*FAm*) Only a few cases are known of EU funding for incineration plants in some Eastern European MS such as PL, EE, BG. Recycling cannot divert all waste from landfill in these MS so complementary measures are needed. But certainly the planning of investments in incineration installations will need to be based on conservative estimates of the future waste amounts available for incineration, taking into account high amounts of recycling.

Panel discussion:

- 1) In your opinion, what actions should the Commission take now?

FGi (ARC): As far as ES is concerned, EU-level targets are needed for all regions to adopt bio-waste recycling strategies, since each Autonomous Community can decide on its own waste policy. A clear communication is also needed concerning the cost of separate collection and the need to optimize the waste collection system. Catalonia has no good experiences with MBT treatment combined with AD. Problems with the digestate quality and a lot of mechanical issues have arisen. So if mixed waste is biologically treated, than composting is the better treatment method.

YDe (FEAD): The development of a simple system for measuring compliance with the target/progress is essential. The target should not only be based on EoW criteria. The methods used by different laboratories for determining compost quality should be identical, before any targets related to quality recycling are defined.

ESt (CEWEP): A proper implementation of the WFD and Landfill Directive should be ensured. This implies support to MS struggling with compliance. A definition of 'high quality recycling' is needed, before setting any realistic target. A step by step approach should be adopted.

Pee (EE): Support of the EU for the construction of new bio-waste treatment capacity is needed.

FAm (ECN): It must clearly be communicated that bio-waste recycling in most cases reduces the waste treatment costs and provides a marketable output, if source separated. An unambiguous definition of bio-waste is needed, but the WFD definition is quite clear. Targets must be accompanied by an adequate transition period. It might be a good idea to start off with a very low level target, which is easy to measure, say 20-30 kg separately collected bio-waste/inhabitant.year. In this way MS are obliged to at least introduce some separate collection systems and everyone will get used to it, misconceptions will disappear.

ABI (MWE): If EU-level targets are set, support needs to be provided for their calculation: uniform calculation methods are required. The need for local flexibility should be taken into account.

SLo (LIPOR): The importance of organic matter for soils should be pointed out. Source separation of bio-waste is crucial. Quality criteria must be developed. Specific MS circumstances must be accounted for. It should be ensured that the same methods for evaluating these criteria are used in all laboratories.

GSt (BG): Separate collection and bio-waste recycling is difficult to introduce in new MS due to the associated costs. Funding is needed.

LFr (VITO): Can DG Environment influence the EU funding for waste treatment investments? *BZa*: Yes, but the problem is that MS prefer to use the available funds for huge investments (such as incineration plants) rather than for small biological treatment plants.

- 2) In what aspects should there be flexibility, what does 'sufficient flexibility' mean?

FGi: It should be possible to start with large bio-waste producers. These provide a waste stream which is not complicated to separate, so MS and municipalities can learn from the experience. The inclusion of/support for home composting provides flexibility to small towns. Different targets could be set for different kinds/qualities of bio-waste.

YDe: Flexibility could be ensured by setting a target which gradually increases over time as well as by leaving the possibility for MS to choose between different target types.

PEe: The perceived need for flexibility hinders developments in environmental legislation. In many MS nothing happens if there is no EU imposed target to be reached. Targets should be set for the national level.

FAm: A target imposed at the national level ensures flexibility. No further details should be specified. In many MS the national opinion on bio-waste recycling depends on the individual persons in charge. Urgent steps are needed, since many countries are investing in methods for diverting waste from landfill and capacity for incineration is being put in place. This will lead to problems for increasing recycling rates later on.

ABl: Targets should not be limited to a specific technology.

SLu: A simple, low target imposed at the national level is needed. There must be enough flexibility to deal with the issue of garden waste incineration vs. recycling. The time frames seem to be very limited: the decision on whether or not to impose specific bio-waste targets will be taken in 2014, while the Landfill Directive targets are to be reached by 2020. In SE it took almost 10 years to establish a well-functioning bio-waste collection and treatment system.

SLo: A target imposed at the national level, which is sufficiently low and takes account of the current recycling rates of the MS, may provide sufficient flexibility. Some MS never succeed in meeting EU targets on time, since time is needed to develop the necessary infrastructure. The target and its scope should be clearly defined.

GSt: Sufficient time is needed for the infrastructure to be put in place.

BZa: That is the reason why a lower target is recommended in the Communication. This would provide sufficient lead times for MS.

Further discussion

- EoW criteria will be developed first (by 2014), but in many MS the waste treatment infrastructure will not yet be in place. Is a link between bio-waste recycling and EoW criteria useful then? Wouldn't it be better the other way around? Since the timing as it is now could lead to compost being transported across the EU, which is contrary to the locality principle. (*BE Wallonia*) It would be best not to link recycling targets to EoW criteria, but simply require quality recycling. (*FAm*) At present, soil quality standards differ between the MS. A common EoW standard for compost/digestate would therefore be useful. (*BZa*)
- At the moment authorities are not taking into account potential bio-waste related legislation when planning investments. An incineration and MBT overcapacity is being developed. This may form a serious issue when imposing bio-waste targets later on. (*GAIA*) E.g. PT is now investing in MBT plants in order to fulfill the Landfill Directive targets. (*SLo*) MBT plants could gradually be transformed into composting plants. In that case, care should be taken not to mix the 'clean' and 'dirty' waste/compost streams. (*FGi*)
- During the presentation and discussions many barriers to bio-waste recycling were identified: pressure of the political level, an attitude of 'why do more than the Commission wants us to do?' (which also exists in DE), current investments in MBT/incineration capacities, financial pressure, etc. The existing legislation appears insufficient for promoting bio-waste recycling, while this would bring about many positive environmental effects. A clear political signal at EU level is needed. (*DE*)
- In IE, EU targets have driven recycling. Without targets, recycling levels/practices in IE would not be where they are now. But a bio-waste target needs to be sufficiently low, since redirecting

waste flows is a slow process. A flexible interpretation combined with a tutor approach is needed for those MS which currently show low recycling levels. Higher targets could be set for those who already perform quite well. The Irish waste industry mentions the lack of sufficient treatment infrastructure and the associated costs as most important barriers to bio-waste recycling. *(IE)* Once again it is obvious that a country's waste management practices strongly depend on who has the power. With another minister, IE would probably be focusing on MBT instead of on composting/AD. *(FAM)*

- We might miss out on other useful applications e.g. biofuels if recycling is favoured. *(NL)* However, a low recycling target still allows for sufficient freedom to explore other (potential) bio-waste applications. *(FAM)* Of course, it can be expected that competition for the easily collectable waste streams will arise. But a change in definition of recycling could cover this issue. *(BZa)* Combined targets for recovery and recycling would allow for more effectively controlling GHG emissions. *(JHo)* In that case both a recycling and a recovery target should be set, not only a recovery target. *(YDe)* The control of GHG emissions is already covered by the Landfill Directive. Now we are looking into the next step: the best methods to reduce GHG emissions. The current definition of recycling does therefore seem quite appropriate. *(FAM)*

ANNEX C: CALCULATION OF UNIT COSTS

In order to undertake a cost-benefit analysis, we do not only need mass flows for each waste management option, but also unit costs. The resources and timeframe allocated to this study do not allow a fundamental revision of the unit costs used in the ARCADIS-Eunomia study. Therefore, we have maintained these unit costs.

The ARCADIS-Eunomia report provides information on projected mass flows for each policy scenario and on the net present value of the net benefits of each policy scenario. However, unit costs are not always provided. Therefore, an indirect approach was needed to estimate these unit costs.

We outline the methodology used below.

For each individual country, the result of 4 policy scenarios have been reported in the ARCADIS-Eunomia report:

- “high prevention and recycling scenario” (scenario II and IIA)
- “low recycling scenario” (scenario III and IIIA)

In the “A” variant, it is always assumed that the food waste that is collected on top of the quantities that were collected in the baseline scenario, is sent to AD (the option with the highest benefits in term of GHG reductions). In the “standard” scenario II and III, it is assumed that food waste that is collected on top of the quantities that were collected in the baseline scenario, is sent to the treatment option that brings the highest net benefits to society (including the other environmental effects and financial costs).

The following mass flows projections are reported in the ARCADIS/Eunomia report:

- Waste generated (total municipal waste, split up in biowaste and non-biowaste)
- Quantities of biowaste collected in the mixed fraction according to the treatment method (landfill, incineration, MBT)
- Quantities of biowaste collected separately according to the treatment method (compost, home compost, AD)

The following costs are reported:

- The private financial costs (using private discount rates and using market prices)
- The social financial costs (using the public discount rates, and after correction of market prices for taxes and subsidies)
- The environmental costs
- The net costs to society (social financial costs + environmental costs)

For the purposes of this project we focus on the following costs and benefits *for the whole projection period 2013-2020*:

- The social financial costs

- The environmental costs
- The net costs to society

As the unit costs depend on the share of food and green waste in each waste management option, we also use the information on these shares.

We can then proceed with the actual calculations.

For each policy scenario i ($i = \text{II, IIA, III, IIIa}$), the net present value of costs j ($j = \text{social financial, environmental}$), are given by the following expression:

$$(NPV)_{i,j} = \sum_{n=2013}^{2020} \frac{(UC)_{F,n,j} \cdot (\Delta F)_{n,i}}{(1+r)^{n-2009}} + \sum_{n=2013}^{2020} \frac{(UC)_{G,n,j} \cdot (\Delta G)_{n,i}}{(1+r)^{n-2009}}$$

If the unit costs are constant over time, this expression can be re-arranged as follows:

$$(NPV)_{i,j} = (UC)_{F,j} \cdot \sum_{n=2013}^{2020} \frac{(\Delta F)_{n,i}}{(1+r)^{n-2009}} + (UC)_{G,j} \cdot \sum_{n=2013}^{2020} \frac{(\Delta G)_{n,i}}{(1+r)^{n-2009}}$$

If we have the NPV for two policy scenarios $i1$ and $i2$, then we have the following sets of equations:

$$\begin{cases} (NPV)_{i1,j} = (UC)_{F,j} \cdot \sum_{n=2013}^{2020} \frac{(\Delta F)_{n,i1}}{(1+r)^{n-2009}} + (UC)_{G,j} \cdot \sum_{n=2013}^{2020} \frac{(\Delta G)_{n,i1}}{(1+r)^{n-2009}} \\ (NPV)_{i2,j} = (UC)_{F,j} \cdot \sum_{n=2013}^{2020} \frac{(\Delta F)_{n,i2}}{(1+r)^{n-2009}} + (UC)_{G,j} \cdot \sum_{n=2013}^{2020} \frac{(\Delta G)_{n,i2}}{(1+r)^{n-2009}} \end{cases}$$

The unit costs have then be obtained by solving these sets of equations for each individual country and waste treatment technology.

If, for a given country, the two other policy scenarios are available as well, then we have recalculated the unit costs using the same procedure, in order to verify consistency. All our results turned out to be indeed consistent.

In some cases, this consistency check was possible, but not always. It is for instance possible that scenario II and IIA (and scenario III and IIIA) are identical because AD is also the optimal solution for food waste from a social point of view. In this case, at the most two scenarios will be available. However, taking into account that our consistency checks always led to positive results wherever they were applied, we are confident that our approach was sound.

Also, for several countries, the targets of scenario III are less ambitious than the baseline scenario. In these cases, the reported changes are zero, and scenario III and IIIA do not provide any additional information.

Thus, the following cases can be expected:

- Scenario II, IIA, III and IIIA are all different: we have then calculated two values of the unit costs and verified whether they are equal (up to rounding errors)

- Scenarios II and IIA (and III and IIIA) are identical: we have used the NPV under II and III to calculate the unit costs
- Scenario II is different from IIA, but the mass flows under scenario III are zero: we have used the NPV under II and IIA
- Scenario II is equal to IIA, and the mass flows under III are zero: in this case, there is no unique solution for the set of equations we have described above; we have then calculated average unit costs for the *given* food/green ratio for each waste management option; we have assumed that these average costs also apply to the new food/green ratio for each new scenario.

These average unit costs are calculated as follows:

$$(UC)_j = \frac{(NPV)_{i,j}}{\sum_{n=2013}^{2020} \frac{(\Delta F)_{n,i}}{(1+r)^{n-2009}} + \sum_{n=2013}^{2020} \frac{(\Delta G)_{n,i}}{(1+r)^{n-2009}}}$$

The resulting estimates are reported in Table 14 and Table 15. In some cases, no country-specific unit costs were identified. However, this did not turn out to cause any problem for the new simulations:

- In the case of home composting, we have used a unit cost of 19,4 EUR per ton where country-specific data were not available.
- In all the other cases, the corresponding changes in mass flows were zero wherever unit costs were not available – therefore, the absence of data on unit costs did not matter.

Using the same approach, we have also estimated emission factors for greenhouse gasses, both including and excluding biogenic carbon (see Table 16). The emission factors have been calculated for the EU27 as a whole (using data on total mass flow changes and total emissions). For sensitivity analysis, we have also calculated the emission factors for one country with an energy mix that is “carbon rich” (Poland) and for one country with an energy mix that is relatively “carbon poor” (France).

Table 14: Financial unit costs (EUR per tonne)

	Landfill		Incineration		MBT		IVC		HC	AD	
	Food	Garden	Food	Garden	Food	Garden	Food	Garden		Food	Garden
AT	33,4	33,4	104,7	104,7	112,8	112,8	40,0	40,0	19,5	72,4	72,4
BE-BR	37,4	37,4	112,2	110,9	na	na	68,1	45,6	19,3	102,8	102,1
BE-FL	37,4	37,4	111,7	111,7	68,9	68,9	57,0	57,0	19,4	101,2	101,2
BE-WA	37,4	37,4	112,0	112,0	na	na	68,1	45,6	19,4	102,8	101,2
BG	26,5	22,3	105,0	103,7	42,6	47,1	49,8	33,7	19,4	63,2	63,2
CY	19,3	5,0	104,9	103,3	46,3	45,4	52,4	18,9	18,3	56,7	56,7
CZ	25,5	17,6	95,2	93,0	69,9	68,8	10,8	10,8	na	77,3	73,6
DK	36,4	36,4	82,4	82,4	na	na	68,8	46,1	19,4	107,6	107,6
EE	29,8	23,7	109,7	108,5	45,1	51,1	31,1	35,0	19,5	85,3	85,3
FI	39,8	39,8	112,4	112,4	na	na	65,3	43,9	19,5	82,1	113,2
FR	43,3	38,9	117,3	116,4	64,8	73,1	67,2	45,0	na	93,7	93,7
DE	34,2	34,2	105,2	105,2	113,2	113,2	65,4	43,9	na	103,4	92,2
EL	26,5	22,2	92,6	91,4	48,0	51,6	54,1	36,5	na	87,4	87,4
HU	24,2	24,2	83,9	83,9	45,6	45,6	52,7	35,6	19,5	85,1	85,1
IE	32,4	32,4	116,5	116,5	61,1	61,1	64,1	43,1	19,4	99,4	85,9
IT	30,1	30,1	95,7	95,7	86,3	86,3	64,2	43,1	na	91,1	70,9

LV	24,8	18,4	80,0	80,0	43,0	47,5	50,6	34,2	19,6	79,9	79,9
LT	24,9	18,0	17,0	28,6	43,5	47,8	51,1	34,5	19,4	82,4	82,4
LU	23,9	23,9	109,2	109,2	na	na	68,3	45,8	na	109,0	97,5
MT	21,5	9,0	na	na	67,7	65,9	18,9	18,9	19,3	60,5	60,5
NL	37,3	37,3	113,0	113,0	63,4	63,4	66,0	44,3	na	104,3	85,0
PL	23,7	23,7	101,9	100,2	70,2	69,3	52,3	18,4	na	69,4	69,4
PT	31,4	26,7	99,6	98,7	49,7	55,3	55,5	37,4	19,5	93,3	80,9
RO	25,9	20,8	86,0	86,0	43,0	47,2	50,3	34,0	19,5	78,8	78,8
SK	23,4	14,6	80,8	79,0	44,1	47,7	16,0	16,0	19,4	53,5	53,5
SI	29,0	22,3	103,2	100,9	49,2	54,6	55,6	37,5	na	Na	0,0
ES	32,3	25,8	97,8	96,5	53,4	57,9	58,4	39,3	19,5	81,7	84,9
SE	35,5	35,5	91,3	91,3	64,3	64,3	17,5	17,5	19,5	68,9	68,9
UK	32,4	32,4	96,6	96,6	61,5	61,5	64,1	43,1	na	99,1	38,5

Table 15: Environmental unit costs (EUR per tonne)

	Landfill		incineration		MBT		IVC		HC	AD	
	Food	Garden	Food	Garden	Food	Garden	Food	Garden		Food	Garden
AT	66,9	na	14,5	-37,8	31,5	31,5	14,7	14,7	24,6	-10,5	-10,5
BE-BR	76,2	na	4,2	16,9	na	na	4,1	4,1	56,4	-7,4	0,2
BE-FL	76,2	na	5,1	15,8	42,6	42,6	4,1	4,1	56,6	-1,9	-1,9
BE-WA	76,2	na	5,1	12,1	na	na	4,1	4,1	56,5	-7,3	0,7
BG	57,1	90,8	7,5	18,7	17,0	30,6	4,5	2,2	5,1	-0,7	-0,7
CY	55,7	89,2	2,8	13,7	18,3	32,1	2,2	1,7	4,6	0,0	na
CZ	78,3	128,7	12,6	22,6	17,8	35,5	42,8	42,8	Na	0,0	0,0
DK	58,6	na	8,8	211,9	na	na	4,1	4,5	16,9	0,0	na
EE	56,1	93,3	2,8	13,8	18,7	32,8	4,4	2,8	6,9	0,0	na
FI	51,2	118,1	11,2	9,7	na	na	4,5	2,2	5,8	-0,9	0,1
FR	74,2	120,4	50,3	62,4	24,2	40,5	3,8	2,8	Na	0,0	na
DE	71,6	na	-12,1	-14,1	35,0	35,0	3,5	6,7	Na	-22,7	-6,6
EL	57,3	92,1	3,3	14,4	18,4	32,6	4,5	2,6	Na	0,0	na
HU	62,2	195,8	24,5	57,1	25,4	25,4	4,2	3,5	22,3	0,0	0,0
IE	54,6	118,7	12,0	28,5	24,2	24,2	4,0	3,7	7,0	-11,6	-20,5
IT	62,7	120,6	18,9	37,7	25,1	25,1	4,0	4,5	Na	-10,4	1,6
LV	59,4	95,0	17,4	na	17,2	31,4	4,5	2,0	7,7	0,0	na
LT	59,2	94,8	17,0	28,6	16,8	30,6	4,4	2,0	5,4	0,0	na
LU	75,6	279,4	43,7	75,1	na	na	3,9	3,7	Na	-10,2	5,1
MT	60,8	98,2	0,0	0,0	11,9	25,3	13,0	13,0	16,4	0,0	na
NL	71,9	187,8	-12,8	21,3	35,7	35,7	3,6	6,0	Na	-20,5	-4,5
PL	59,0	na	-1,9	7,6	14,3	27,5	4,2	17,5	Na	0,0	na

PT	59,3	95,3	6,0	16,8	19,4	33,7	4,3	3,1	8,7	-7,5	-3,8
RO	56,7	90,8	8,6	na	17,0	30,8	4,5	2,2	5,0	-2,3	na
SK	72,2	118,1	30,5	42,7	24,5	41,0	26,6	26,6	27,7	0,0	na
SI	73,1	118,4	26,0	36,9	26,3	42,4	4,1	4,3	Na	0,0	0,0
ES	61,7	99,2	14,4	25,4	20,0	34,4	4,2	2,2	10,0	-3,5	-2,6
SE	56,1	na	23,3	-7,7	22,9	22,9	10,6	10,6	13,0	-2,5	-2,5
UK	64,6	138,3	10,0	20,3	32,9	32,9	4,3	4,6	Na	-13,0	3,3

Table 16: GHG emission factors

		Landfill - food	Landfill- green	Incineration - food	Incineration - green	MBT - food	MBT - green	Composting - food	Composting - green	Home Composting	AD - food	AD - green
Unit GHG including Organic Carbon												
EU 27		1,3	2,4	0,3	0,8	0,5	1,1	0,5	0,4	0,4	0,3	-0,6
FR		1,3	2,5	0,4	0,9	0,6	1,1	0,5	0,4	na	0,4	na
PL		na	na	0,2	0,6	0,4	0,9	0,4	0,4	na	0,3	na
Unit GHG excluding Organic Carbon												
EU 27		0,9	1,8	-0,2	-0,2	0,1	0,2	0,1	0,0	0,0	-0,1	-0,2
FR		1,0	1,8	-0,1	-0,1	0,1	0,2	0,1	0,0	na	-0,1	na
PL		na	na	-0,3	-0,3	0,1	0,1	0,0	0,0	na	-0,2	na

ANNEX D: SUPPORT FOR RENEWABLE ENERGY

The countries marked with a * have reported changes in their support schemes in the stakeholder consultation (cf. Annex A, question 6).

The table below shows that for the majority of countries (18) no relevant changes to legislation are reported in the 2009 country profiles. In the countries where the schemes were modified, most changes included an introduction of a feed-in tariff scheme or major changes to the scheme (AT, CY, SI, LV, LU, FI, DE, UK). Cyprus and Finland also introduced new possibilities for subsidies.

Bulgaria, Ireland and the UK introduced additional feed-in tariffs: Bulgaria for electricity from biogas, Ireland for electricity from anaerobic digestion and high efficiency CHP and the UK for smaller plants. The Netherlands and Greece raised their feed-in tariffs in general. Cyprus, Lithuania, Luxembourg, Slovenia showed higher feed-in tariffs for biomass. Cyprus, Slovakia, Slovenia and Denmark showed higher feed-in tariffs for biogas.

Table 17: Relevant changes in the 2009 Renewable Energy Country Profiles compared to the 2008 Country profiles

Country	Changes to supporting policies relevant to biowaste recycling	Changes to feed-in tariffs, premium tariffs and the like relevant to biowaste recycling⁹⁵
AT	In 2009 the Austrian Green Electricity pact (Ökostromgesetz 2002) was amended in order to increase the security of investment for RES-E developers by for instance improving the feed-in tariff system	The 2009 country profile reports an extended guaranteed period for feed-in tariff to 15 years for feedstock dependent installations and the possibility of higher feed-in tariffs.
BE (Flan)	In the 2009 country profile no new relevant amendments to legislations are found	New minimum prices for new projects (as of 2010), biomass and others: 90 €/MWh for 10 years (before 80 €/MWh).
BE (Wall)	In the 2009 country profile no new relevant amendments to legislations are found	-
BE (Brus)	In the 2009 country profile no new relevant amendments to legislations are found	-

⁹⁵ Price changes certificates in quota systems that are due to market are not reported

BG	In the 2009 country profile no new relevant amendments to legislations are found	The feed-in tariffs for electricity from biomass have not changed significantly in the 2009 profile, but new tariffs specifically for biogas have been added. <table border="1"> <thead> <tr> <th></th><th>2008 country profile (€/MWh)</th><th>2009 country profile (€/MWh)</th></tr> </thead> <tbody> <tr> <td colspan="3">Biomass < 5MW</td></tr> <tr> <td>Wood waste</td><td>110</td><td>110,95</td></tr> <tr> <td>Agricultural residues</td><td>83</td><td>84,88</td></tr> <tr> <td>Energy crops</td><td>94</td><td>95,61</td></tr> <tr> <td colspan="3">Biogas</td></tr> <tr> <td>< 150 kW</td><td>-</td><td>101,19</td></tr> <tr> <td>150 kW - 500 kW</td><td>-</td><td>92,85</td></tr> <tr> <td>500 kW - 5MW</td><td>-</td><td>84,52</td></tr> </tbody> </table>		2008 country profile (€/MWh)	2009 country profile (€/MWh)	Biomass < 5MW			Wood waste	110	110,95	Agricultural residues	83	84,88	Energy crops	94	95,61	Biogas			< 150 kW	-	101,19	150 kW - 500 kW	-	92,85	500 kW - 5MW	-	84,52
	2008 country profile (€/MWh)	2009 country profile (€/MWh)																											
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500 kW - 5MW	-	84,52																											
CY	2009: In Cyprus the policy framework for RES has been recently revised and approved. This framework provides feed-in tariff systems and different types of subsidies depending on the size of the project and the type of implementing enterprise.	The 2008 country profile shows a fixed feed-in tariff for 15 years of 63 €/MWh for biomass, landfill and sewage gas in 2005 and 2006. The 2009 country profile shows feed-in tariffs for grid connected systems of 135 €/MWh for biomass and 114,5 €/MWh for biogas in 2009 and 2010. For heating and CHP using biomass different subsidies are possible with a subsidy percentage over project budget ranging from 15% to 55% with maximum subsidies ranging from €19.000 to €680.000. The cost for construction of production plants for biofuels (incl biogas) are eligible for a subsidy of 15% to 40% with maximum subsidies ranging from €200.000 to €680.000.																											

CZ	In the 2009 country profile no new relevant amendments to legislations are found	Feed-in tariffs and premiums are calculated annually by the Energy Regulatory Office (ERO). <table><tr><th>€/MWh</th><th colspan="2">Latest from 2008 country profile (€/MWh, 2008)</th><th colspan="2">Latest from 2009 country profile (€/MWh, plants started in 2010)</th></tr><tr><th></th><th>Feed-in</th><th>Premium</th><th>Feed-in</th><th>Premium</th></tr><tr><td>Biomass combustion</td><td>93-161</td><td>44-112</td><td>97-168,9</td><td>61,2-133,1</td></tr><tr><td>Biomass with fossil fuels</td><td>-</td><td>9-63</td><td>-</td><td>1,8-60,5</td></tr><tr><td>Biogas</td><td>89-149</td><td>40-10</td><td>130,9-151,9</td><td>95,1-127,2</td></tr><tr><td>Landfill gas and sewage gas</td><td>-*</td><td>-*</td><td>91.1</td><td>55,3</td></tr></table> * It is not clear whether landfill gas and sewage gas are considered as biogas in the 2008 country profile The 2009 country profile provides an overview of different subsidy programmes. It is hard to tell whether they are new or not.	€/MWh	Latest from 2008 country profile (€/MWh, 2008)		Latest from 2009 country profile (€/MWh, plants started in 2010)			Feed-in	Premium	Feed-in	Premium	Biomass combustion	93-161	44-112	97-168,9	61,2-133,1	Biomass with fossil fuels	-	9-63	-	1,8-60,5	Biogas	89-149	40-10	130,9-151,9	95,1-127,2	Landfill gas and sewage gas	-*	-*	91.1	55,3
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Biogas	89-149	40-10	130,9-151,9	95,1-127,2																												
Landfill gas and sewage gas	-*	-*	91.1	55,3																												
DK*	In the 2009 country profile no new relevant amendments to legislations are found	The 2008 country profile reports that new installations producing electricity from solid biomass and biogas receive a feed-in tariff of 80€/MWh for 10 years followed by 54 €/MWh for the next ten years. The 2009 country profile reports that new installations receive 100.1 €/MWh (guaranteed period not specified). If the biogas is mixed with other fuels, the part of the electricity produced from biogas receives a price premium of 54,4 €/MWh. New units producing electricity by burning biomass will receive a premium of 20,2 €/MWh. Heat produced using biogas or biomass with CHP is exempt from energy taxes.																														
EE	In the 2009 country profile no new relevant amendments to legislations are found	Feed-in tariffs and feed-in premiums have remained the same.																														

FI	A draft law mentioned in 2008 country profile has been implemented	<u>Country profile 2009:</u> Tax reimbursements remained the same at 4,2 €/kWh for biomass systems. Up to 40 % of investment costs for RES-E technologies may now be subsidized. The introduction of feed-in tariff is proposed. For electricity from biogas (> 300kW) this would be 50 €/MWh guaranteed for 12 years. A maximum investment subsidy of 30% is available for biomass using plants for both heat production and CHP.																							
FR*	In the 2009 country profile no new relevant amendments to legislations are found	No changes in feed-in tariffs. Possible future introduction of feed-in tariff for biomass.																							
DE*	Renewable Energy Sources ACT (EEG) 25 October 2008 enacted on 1 January 2009	<table><tr><td></td><td>Country profile 2008</td><td colspan="2">Country profile 2009</td></tr><tr><td>€/MWh</td><td>Feed in tariffs 2006</td><td>Support level 2009</td><td>Support level 2010</td></tr><tr><td>Biomass solid (< 20 MW)</td><td>80,3 - 109,9</td><td>77,9-296,7</td><td>77,1-293,7</td></tr><tr><td>Waste wood</td><td>37,2</td><td>-</td><td>-</td></tr><tr><td>Sewage and landfill gas</td><td>63,5-73,3</td><td>41,6-110</td><td>41-108,4</td></tr></table>					Country profile 2008	Country profile 2009		€/MWh	Feed in tariffs 2006	Support level 2009	Support level 2010	Biomass solid (< 20 MW)	80,3 - 109,9	77,9-296,7	77,1-293,7	Waste wood	37,2	-	-	Sewage and landfill gas	63,5-73,3	41,6-110	41-108,4
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Sewage and landfill gas	63,5-73,3	41,6-110	41-108,4																						
GR / EL	In the 2009 country profile no new relevant amendments to legislations are found	Feed-in tariffs rose from 73 €/MWh to 80,14€/MWh for the mainland and from 84,6€/MWh to 91,74 €/MWh for autonomous islands.																							
HU	In the 2009 country profile no new relevant amendments to legislations are found	The reported feed-in tariffs are the same in the 2008 and 2009 country profile.																							

IE	In the 2009 country profile no new relevant amendments to legislations are found	The feed in tariff for landfill gas rose from 70 €/MWh to 81,486 €/MWh and for other biomass from 72 €/MWh to 83,714 €/MWh. For anaerobic digestion and high efficiency CHP an additional feed-in tariff of 120 €/MWh was reported in the 2009 country profile.
IT	In the 2009 country profile no new relevant amendments to legislations are found	The reported feed-in tariffs are the same in the 2008 and 2009 country profile.
LV	The feed-in tariff system has been amended in 2009 through regulation No. 198 on Electricity Generation from RES and the Price Regulation.	The feed-in tariffs are dependent on the end user price of natural gas and the installed capacity of the power plant. Although the 2009 profile reports an amended feed-in tariff system, the reported values in the 2008 profile already seem consistent with this new system.
LT	In the 2009 country profile no new relevant amendments to legislations are found	The feed-in tariffs for biomass rose from 69,5 €/MWh in 2008 to 86,9 €/MWh in 2009
LU	The 2009 country profile reports an amendment of the feed-in tariff system in 2008	The 2008 country profile reports 102,6 €/MWh for biomass and biogas including landfill and sewage gas. The 2009 country profile reports feed-in tariffs from 119,4 -149,25 €/MWh for biogas, 64,68 €/MWh for sewage gas and 124,38 - 144,28 €/MWh for solid biomass.
MT	In the 2009 country profile no new relevant amendments to legislations are found	
NL*	In the 2009 country profile no new relevant amendments to legislations are found	In the 2008 country profile only biogas installations from manure digestion were entitled to a premium of 97 €/MWh. The 2009 country profile provides feed-in premiums for electricity from different biomass sources ranging from 71 €/MWh - 133 €/MWh. For electricity from landfill and sewage gas a premium of 15 €/MWh is reported and for electricity from waste incineration plants a premium of 25-48 €/MWh is reported.
PL	In the 2009 country profile no new relevant amendments to legislations are found	Quota system

PT	In the 2009 country profile no new relevant amendments to legislations are found	The reported feed-in tariffs are the same in the 2008 and 2009 country profile.		
RO	The 2009 country profile reports the establishment of a 2008 law improving the promotion system for production of energy from renewable energy sources. The legislation was however not yet made operational by secondary legislation.			
SK	In the 2009 country profile no new relevant amendments to legislations are found	Feed-in tariffs in the 2009 country profile are higher than in the 2008 country profile.		
		€/MWh	2007 (2008 country profile)	2009 (2009 country profile)
		Biomass combustion	79-129	107-130
		Biomass co-firing	-	104-134
		Biogas combustion	79-129	104-179
SI	A new RES-E support scheme in Slovenia entered into force 12 July 2009	Feed-in tariffs in the 2009 country profile are available for more categories of RES-E technologies and are higher than in the 2008 country profile.		
		€/MWh	2008 country profile	
			<i>Fixed</i>	<i>Premium</i>
				<i>Feed-in tariff</i>
		Biomass	69-70	34-36
		Biomass co-firing		
		Biogas - biomass		
		Biogas -waste	121	
		Sewage gas	49-53	
		Landfill gas	49-53	
		Biodegradable waste		

ES*	In the 2009 country profile no new relevant amendments to legislations are found	Variable feed-in tariff possible for biomass systems
SE*	In the 2009 country profile no new relevant amendments to legislations are found	-
UK*	In April 2009 “technology banding” was introduced in the Renewables Obligation Scheme.	From April 2010 plants under 50kW will be eligible for a new feed-in tariff scheme