European Environment Agency
European Topic Centre on Waste and
Materials in a Green Economy

Annex 1
Country by country analysis

17 April 2018

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Contents

Annex 1 describes and analyses the modelling results in more detail for those Member States identified as being at risk of not meeting the 2020 target of 50 per cent recycling under the 2008 Waste Framework Directive (WFD) (2008/98/EC). It provides results for each of these countries for the period 2015–2025 and shows the changes that will occur when moving from the 2017 baseline scenario to the full implementation scenario. The full implementation scenario assumes that the 50 per cent recycling target is met in 2020, using the method of calculation chosen by the Member State[1], and that the treatment shares stay constant after 2020. In addition, the full implementation scenario assumes that the targets for diversion of biodegradable municipal waste from landfill according to the 1999 EU Landfill Directive (1999/31/EC) are met.

All figures and tables in this annex have been created by the ETC/WMGE for the EEA based on the European Reference model on municipal waste (in the following text called 'the model').

[1] European Commission Decision 2011/753/EU allows countries to choose between four different calculation methods to report compliance with this target. Member States have the option of considering four alternative waste streams and fractions: 1. paper, metal, plastic and glass household waste; 2. paper, metal, plastic, glass household waste and other single types of household waste or of similar waste from other origins; 3. household waste; 4. municipal waste.

1 Bulgaria

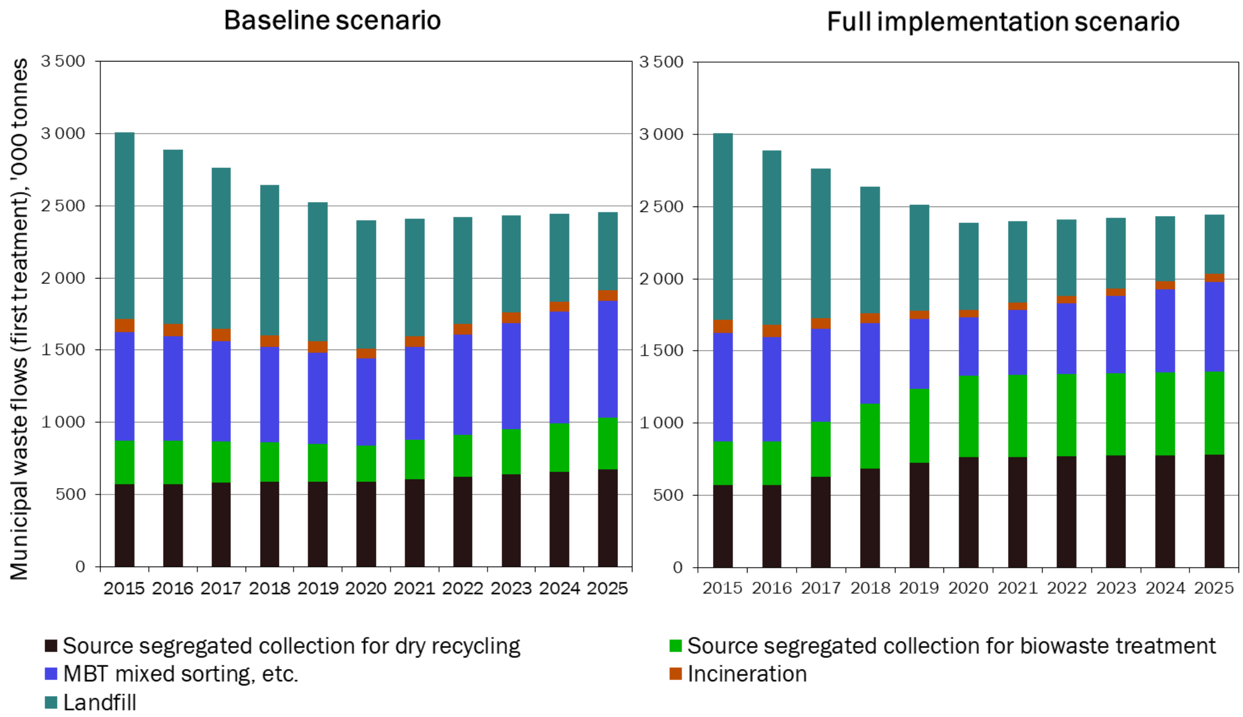
1.1 Development in the destinations of municipal solid waste

Figure 1 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios. We note here that in Bulgaria future waste generation is expected to decrease, mainly due to projected decreases in population[2].

Under both scenarios the amount of waste Bulgaria sends to landfill will decrease, but more quickly under the full implementation scenario. The amount sent for mechanical biological treatment (MBT), on the contrary, is expected to increase slightly in the baseline scenario, and to decrease significantly under full implementation. The reason behind this trend in the baseline scenario is that the country has planned to expand its MBT capacity by 2025. The full implementation scenario does not take this planned capacity increase into account, since it only aims at fulfilling the 50 per cent recycling target of the WFD and the landfill diversion target of the EU Landfill Directive.

Figure 1 also shows the differing growth rates of the shares of municipal solid waste (MSW) separately collected for dry recycling and biowaste treatment in the two scenarios, with a faster increase under full implementation in order to meet the 50 per cent recycling target by 2020. Once this is met under full implementation, there are no further changes in the waste management shares.

Figure 1 Municipal solid waste destinations (first treatment), baseline and full implementation scenarios, 2015–2025



MBT: mechanical biological treatment
Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

[2] Future waste generation is projected based on past waste generation, expected future population and expected future GDP.

1.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 1 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 4 Bulgaria will achieve a recycling rate of 32 per cent by 2020 and 38 per cent by 2025.

However, Table 2 shows that the calculated recycling rate for the year 2015 is 5 percentage points lower than the rate reported by Bulgaria. One possible reason for this difference could be that the model, by default, subtracts losses occurring during the sorting of separately collected waste based on standard reject (loss) rates, while the reported recycling rate might be based on the separately collected amounts. The second row in Table 1 therefore also includes the calculation of recycling rates without subtracting rejects. The corresponding recycling rate would in this case be 36 per cent in 2020 and 43 per cent in 2025.

Table 1 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	26	27	29	30	31	32	33	34	35	37	38
Recycling rate without subtracting rejects (%)	30	31	32	33	34	36	37	38	40	41	43

Table 2 Comparison of modelled calculations and Bulgaria's reported recycling rates according to the chosen method, 2015

Method 4	2015
Recycling rate calculated by the model (%)	26
Recycling rate without subtracting rejects (%)	30
Reported recycling rate (%)	29

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

A possible reason for the lower recycling rate calculated by the model might be differences in rejects: by default, the model subtracts losses occurring during the sorting of separately collected waste based on standard reject (loss) rates, while Bulgaria might report recycled amounts based on the input to pre-treatment plants.

1.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Bulgaria moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

1.3.1 Environmental externalities and financial costs

Figure 2 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs of emissions of greenhouse gases (GHGs) and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Bulgaria the costs related to the full implementation scenario are lower than those related to the baseline scenario, and that the net costs are driven by the externalities. This is mainly due to the switch from a system based on MBT to one with a high share of recycling.

More specifically, financial costs rise a little until 2020, then dip below the zero line between 2020 and 2025, i.e. in moving from the baseline to full implementation there is an implicit financial gain after 2020. The trend in externalities predicts an avoidance of impacts under full implementation up to 2020. The differences between the two scenarios level off after 2020, because in the baseline the recycling rate and share of MBT increase while in full implementation they remain stable.

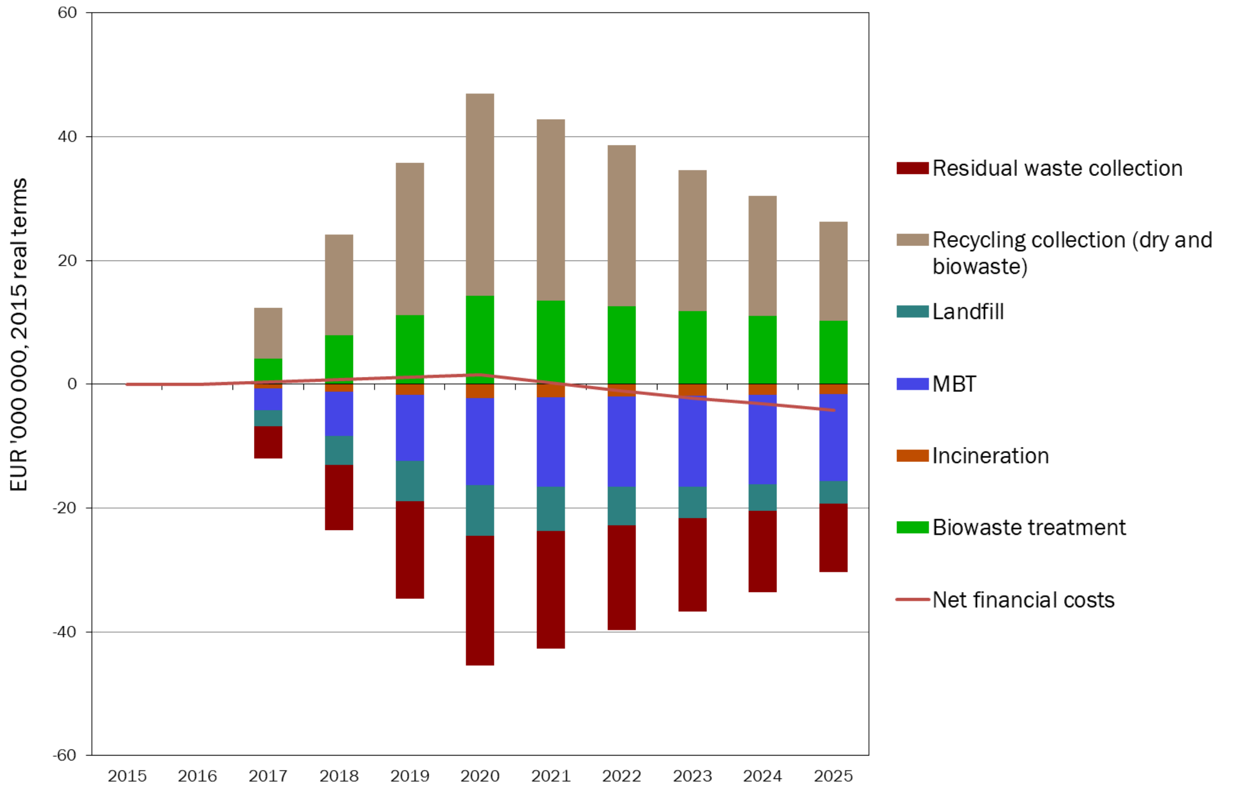
Figure 2 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

Figure 3 shows the split of costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 2.
To reach the 2020 target under full implementation, the model forces the system to increase both separate collection for recycling and biowaste treatment, resulting in higher costs for collection of recyclables and for biowaste treatment under full implementation.

Nevertheless, these higher costs due to increased recycling are more than offset by a decrease in other costs (most notably MBT and residual waste collection). The full implementation scenario implies less residual waste being collected, as well as a change to collection systems with a lower frequency of residual collection (Box 1), reflected in lower costs. As a result, there is a financial benefit after 2020, and before 2020 the increase in costs when moving from baseline to full implementation (when present) is small.

The financial costs differential falls after 2020 because in the baseline scenario – under Bulgaria's plans to install additional MBT capacities after 2020 – the rising share of waste sent to MBT incurs rising costs, but there are no such plans under full implementation. More waste is collected separately for recycling in the full implementation scenario than in the baseline; but the difference gets smaller over time.

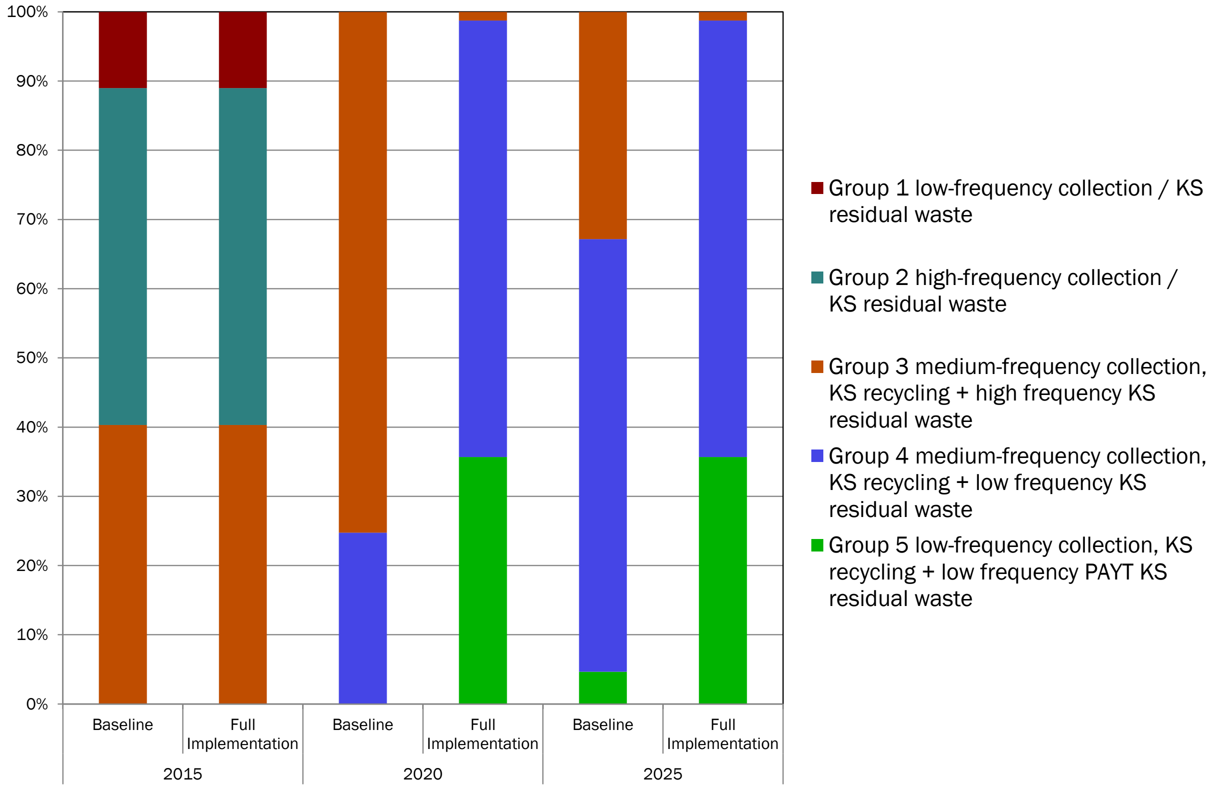
Figure 3 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 1 Bulgaria's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection, and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of residual waste collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Bulgaria, given the large difference in recycling rates between the two scenarios, full implementation implies a completely different configuration of the collection system. The model assumes that by 2020 under full implementation, nearly all households have moved from Groups 1, 2 and 3 to Groups 4 and 5 with a very small amount of Group 3. After 2020 the full implementation scenario remains stable while the baseline scenario by 2025 is still predominantly Groups 3 and 4.

Figure 4 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



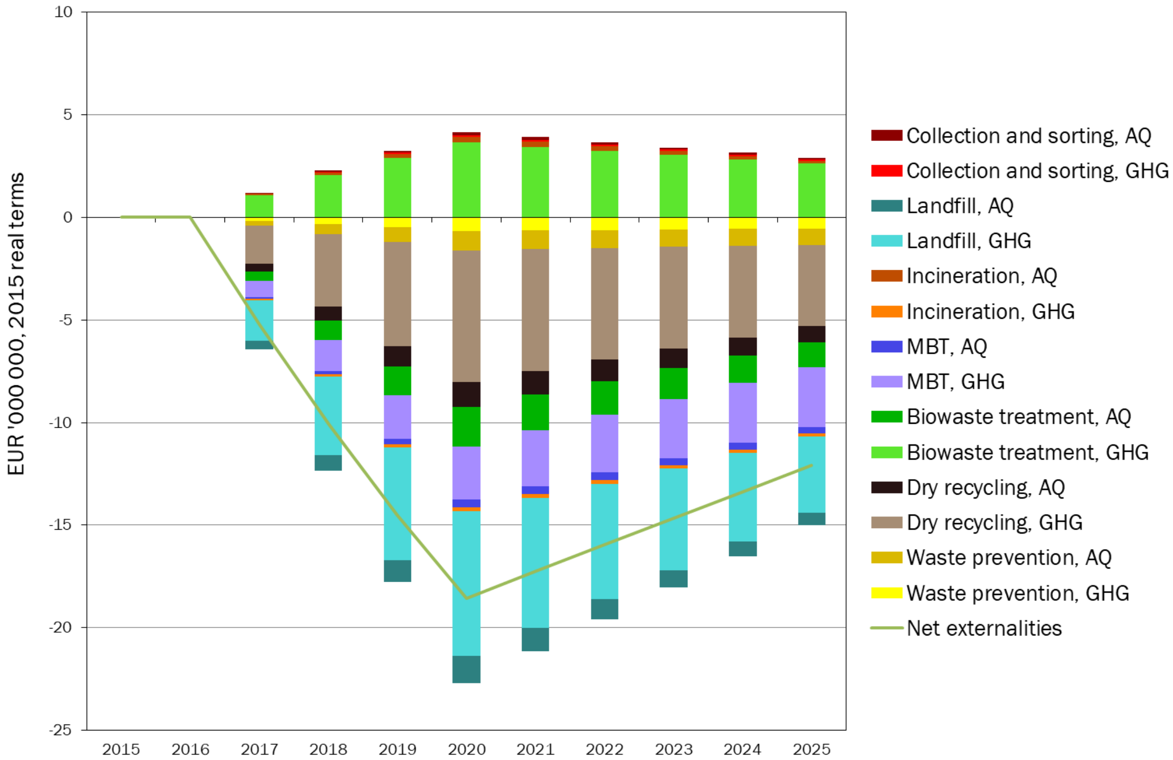
KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: [Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling].

Figure 5 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are those shown in Figure 2.

This result is mainly driven by reduced GHG emissions and, to a lesser extent, air pollutants from less landfill, changes in MBT and more dry recycling in the full implementation scenario compared to the baseline[3]. Higher shares of biowaste treatment lead to more GHG emissions from processing biowaste in the full implementation scenario.

The graph shows that avoided externalities under full implementation in comparison with the baseline peak in 2020. In the period 2020–2025, the difference decreases. This is mainly because the waste management shares stay constant under full implementation, while in the baseline scenario the share of waste sent to MBT increases at the expense of waste sent to landfill.

Figure 5 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



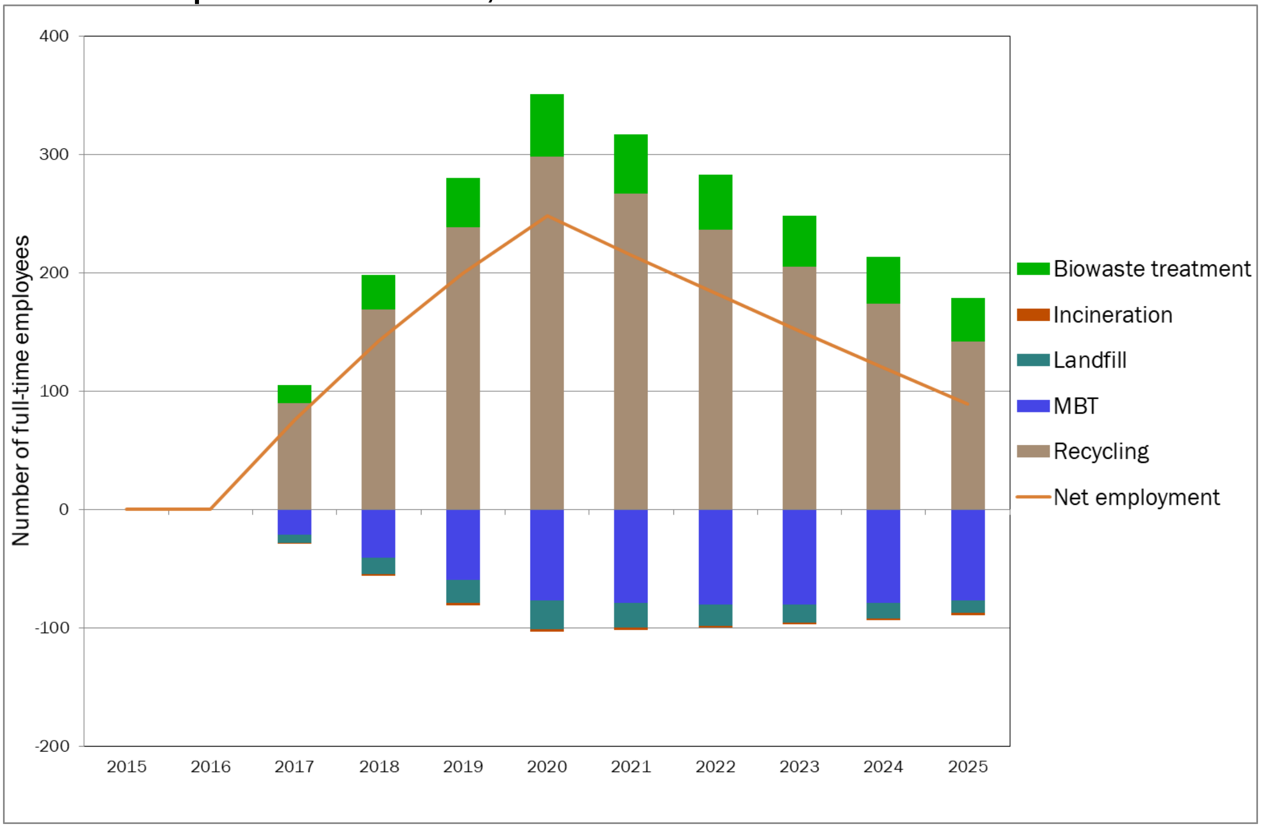
AQ: air quality
GHG: greenhouse gases

1.3.2 Employment

Figure 6 shows a net increase in number of full-time employees under the full implementation scenario. While some jobs are lost in MBT plants, more are created through increasing recycling (collection and processing). The difference between the two scenarios peaks in 2020, when recycling reaches 50 per cent under full implementation, and then starts to decrease.

[3] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 6 Differences in the number of full-time employees in the full implementation scenario compared to the baseline, 2015–2025

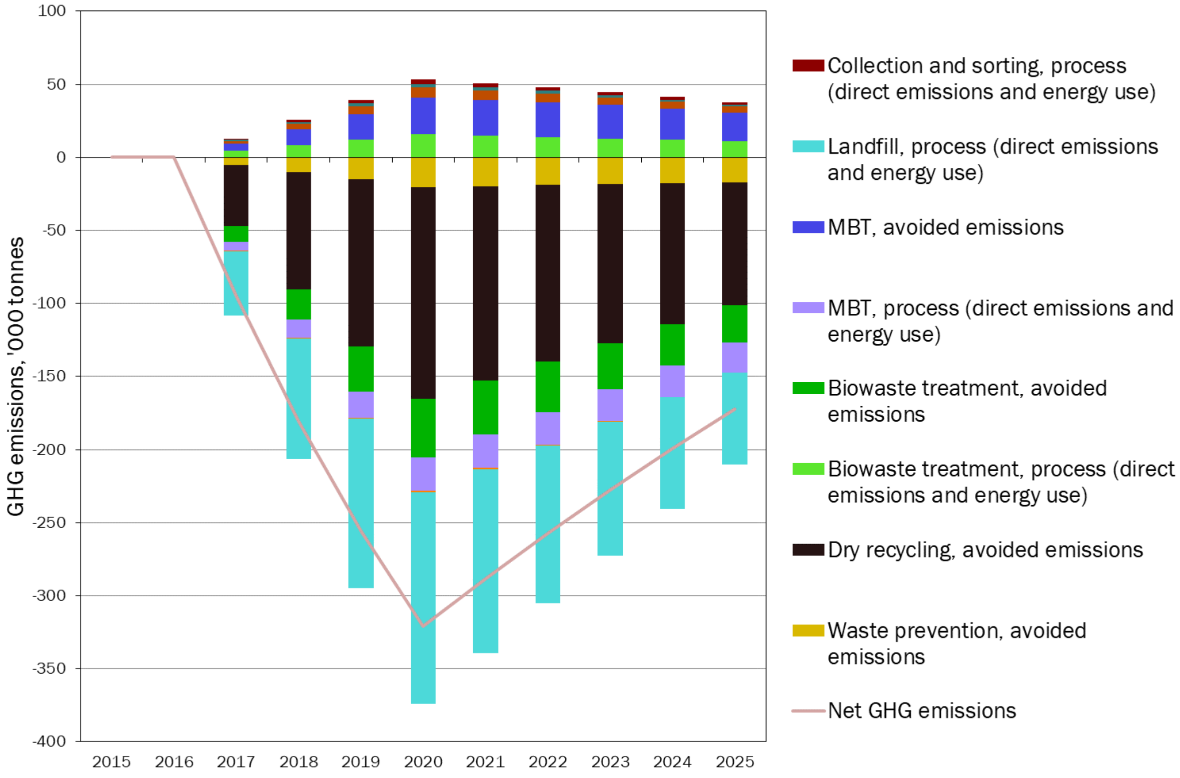


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

1.3.3 Greenhouse gas emissions

Figure 7 shows a significant decrease in net GHG emissions in the full implementation scenario. The largest amounts of avoided GHG emissions result from less landfill and more dry recycling. The difference between the two scenarios reaches its maximum in 2020, then starts to shrink due to the impact of a continued reduction in landfill and a continued increase in dry recycling in the baseline scenario, while the shares in the full implementation scenario stay the same.

Figure 7 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

1.3.4 Conclusion

Bulgaria is at risk of missing the WFD recycling target by 2020, illustrated by the modelled recycling rate of 32 per cent in 2020 (and 36 per cent in case rejects are not subtracted).

Overall, moving from the baseline to the full implementation scenario would, up to 2020, slightly increase the financial costs of MSW management in Bulgaria, but would substantially reduce externalities, especially GHG emissions. At the same time this would create additional employment, mainly in recycling. It is worth stressing that these results also depend on Bulgaria's plan to invest in additional MBT plants, which is reflected in the baseline scenario.

2 Croatia

2.1 Development in the destinations of municipal solid waste

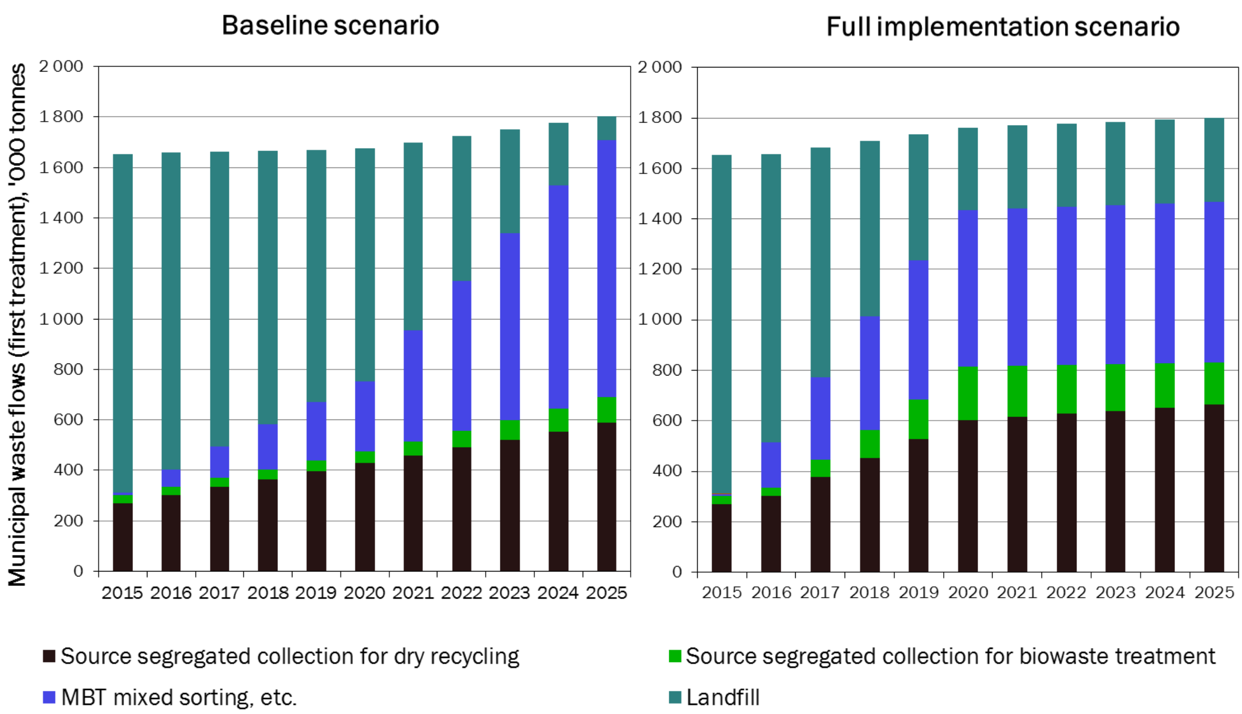
Figure 8 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

Under both scenarios the amount of waste Croatia sends to landfill will decrease and the amount sent for MBT will increase. However, driven by implementation of the Landfill Directive's diversion targets, under the full implementation scenario both the speed of change and the amounts sent to MBT will be greater until 2020. Between 2020 and 2025, however, the amounts going to landfill and MBT in the full implementation scenario will remain constant, whilst in the baseline scenario the share continues to increase at the expense of landfill. This is driven by Croatia's plans to build additional MBT capacity after 2020.

The shares of MSW separately collected for dry recycling and biowaste treatment will increase significantly when moving to the full implementation scenario.

During the period 2020–2025, the amounts sent to landfill diminish further in the baseline scenario while the amounts sent to MBT keep rising; in the full implementation scenario these shares remain constant. By 2025 the amounts collected for dry recycling are similar in both scenarios, though the amounts collected for biowaste treatment are still lower in the baseline scenario.

Figure 8 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

2.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 3 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline modelling, under Method 2 Croatia will achieve a recycling rate of 31 per cent by 2020 and 43 per cent by 2025. By default, the model calculates the recycling rate as input to final recycling, i.e. it subtracts the rejects (losses during sorting). However, Member States may report the separately collected waste as recycled if there are no significant losses (European Commission Decision 2011/753/EU). Croatia achieves higher recycling rates when rejects are included in the calculation.

Table 3 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	16	19	22	25	28	31	34	36	38	40	43
Recycling rate without subtracting rejects (%)	20	24	27	30	34	37	40	42	45	47	50

Table 4 compares modelled calculations and reported data for the year 2015. The recycling rate reported by Croatia is higher than that calculated by the model. However, when the recycling rate is calculated without subtracting rejects, the model arrives at a rate of 20 per cent, closer to the reported data.

Another reason for differences might lie in the way recyclables from MBT processes are calculated by Croatia compared to how this is calculated in the model. Croatia sends a rather high share of generated municipal waste to MBT. The model calculates, based on data from different MBT plants in Europe and expert assumptions, the quantity of recyclables extracted during the MBT process. These extraction rates might differ from the amounts actually extracted for recycling in Croatian MBT plants.

Table 4 Comparison of model calculations and Croatia's reported recycling rates according to the chosen method, 2015

Method 2	2015
Recycling rate calculated by the model (%)	16
Recycling rate calculated by the model without subtracting rejects (%)	20
Reported recycling rate (%)	25

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

Table 5 Comparison of modelled calculations and Croatia's reported amounts of generated and recycled waste, 2015

Method 2	Generated	Recycled
Amounts calculated by the model ('000 tonnes)	887	144
Amounts calculated by the model without subtracting rejects ('000 tonnes)	887	176
Reported amounts ('000 tonnes)	872	215

When comparing the generated amounts of waste as reported by Croatia and calculated by the model the difference is quite small (Table 5). The main difference in the calculated recycling rate (Table 4) lies in the difference between the recycled amounts (Table 5). This is caused by some inconsistencies in the data provided by Croatia in the questionnaire for the model update. For using the data in the model, the ETC/EEA made some adjustments, which causes the differences in the recycled amounts (more details can be found in Annex 2 of this report).

2.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Croatia moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

2.3.1 Environmental externalities and financial costs

Figure 9 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

As Croatia moves from the baseline scenario towards full implementation, the difference in costs increases, with full implementation costs higher than baseline costs by 2020. But as Croatia keeps investing in more MBT in the baseline scenario between 2020 and 2025, the difference in costs decreases, making the baseline scenario more expensive in 2025. The graph shows that the net costs are driven by the financial costs.

Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios diminish after 2020, because in the baseline the recycling rate increases while it is stable in the full implementation scenario.

Figure 9 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

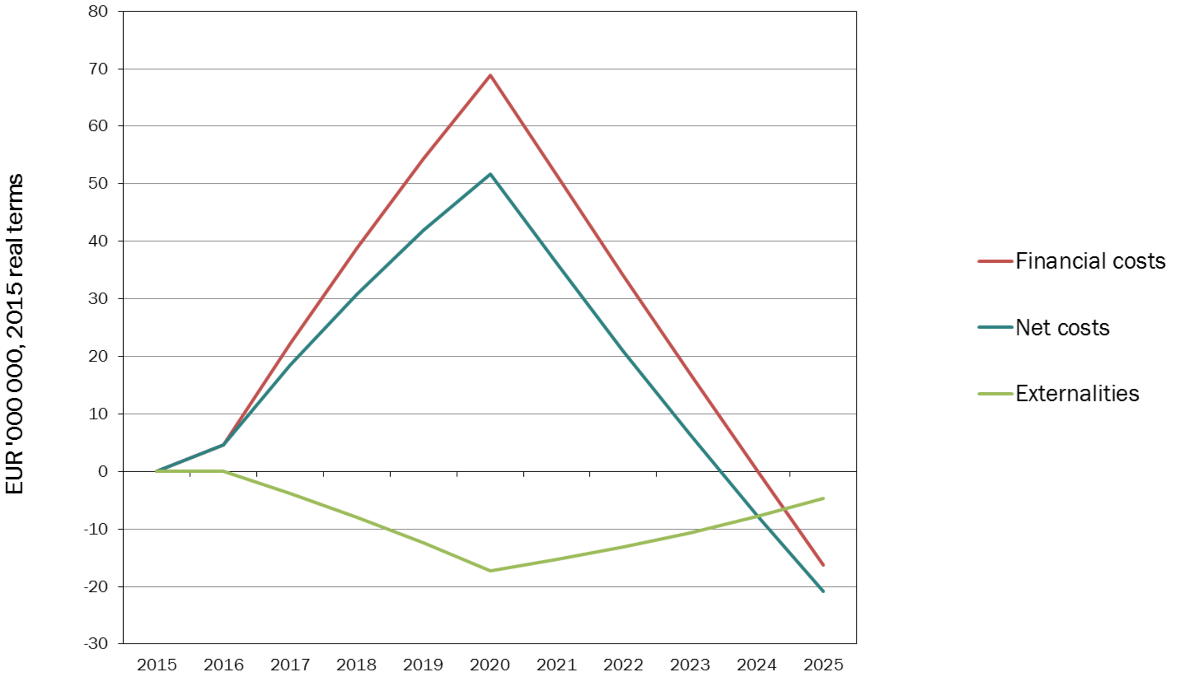
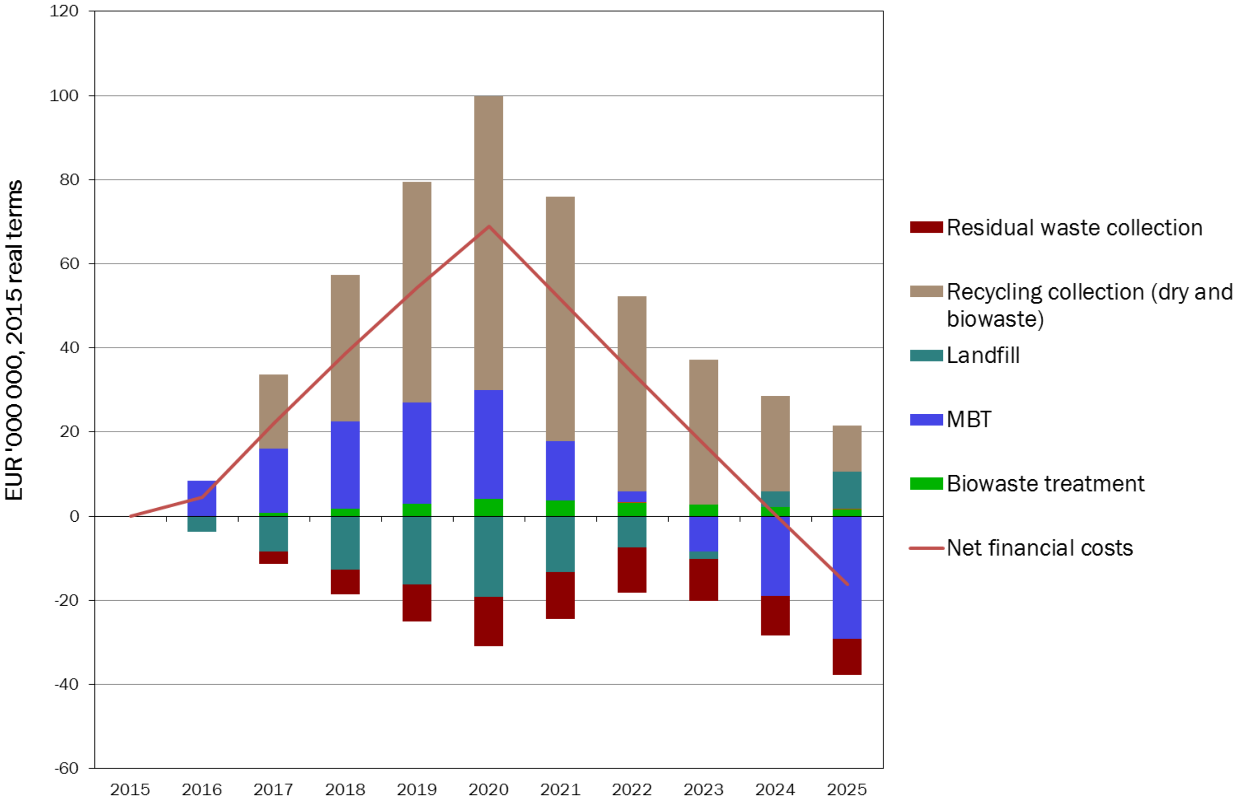


Figure 10 shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are the financial costs shown in Figure 9.

Developments in the full implementation scenario are driven by the landfill diversion targets of the Landfill Directive and the 50 per cent recycling target of the WFD. To reach the landfill diversion targets, the model assumes that a certain amount of waste is diverted from landfill to MBT. This results in higher MBT costs and lower landfill costs in the full implementation scenario up until 2023; there are also higher costs related to waste collection for recycling. After 2023, net costs fall in the implementation scenario relative to the the baseline owing to the continuous increase in MBT that would take place in the baseline.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the additional costs for collection for recycling diminish as the baseline collection rates for recycling move nearer the full implementation rates (Box 2) (Figure 10).

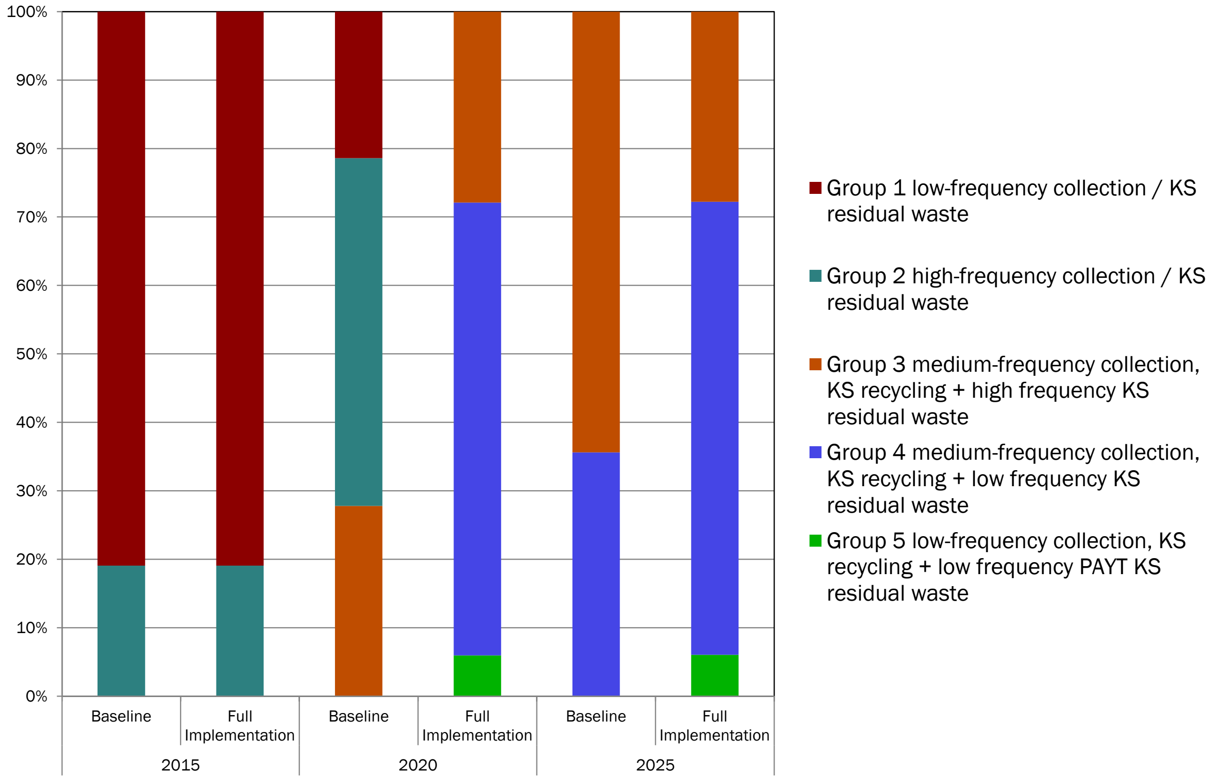
Figure 10 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 2 Croatia's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Croatia, as the differences in recycling rates between the two scenarios are significant in 2020, the model assumes a change from a combination of Groups 1, 2 and 3 collection systems to a combination of Groups 2, 3 and 4 when moving from the baseline to full implementation. The difference between assumed collection systems is large in 2020 and diminishes thereafter, though still assuming a more advanced combination of collection systems in the full implementation scenario.

Figure 11 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



KS: kerbside collection

PAYT: pay as you throw

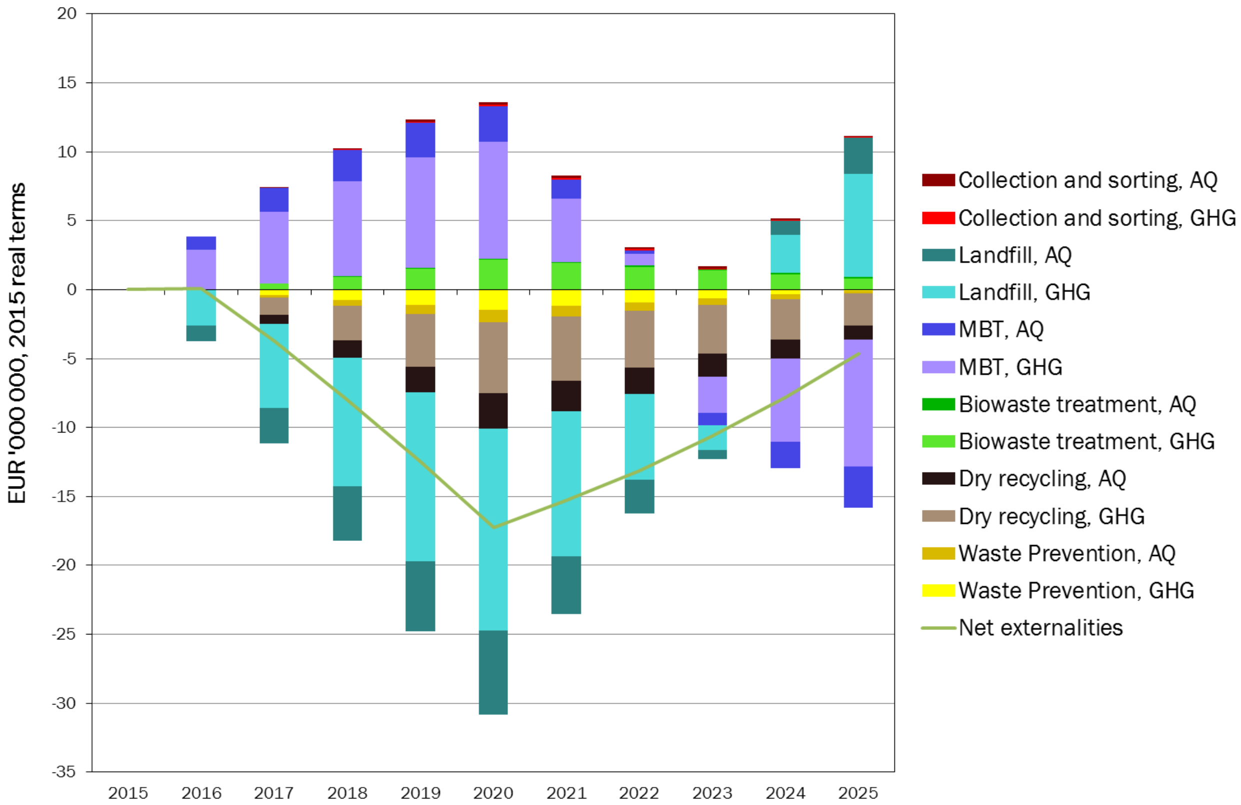
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 12 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are those shown in Figure 9.

This result is mainly driven by reduced GHG emissions from landfill up to 2023 and recycling in the full implementation scenario. In addition, avoided externalities related to emissions of air pollutants from landfill and recycling influence the result. There are, however, externalities caused by higher GHG emissions and air pollutants from MBT treatment up to 2022 in the full implementation scenario. The small waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste leads to higher awareness of citizens on food waste.

The graph shows maximum avoided externalities under full implementation compared to the baseline in 2020. Changes in the period 2020–2025 reflect that the recycling rates in the baseline move closer to the full implementation scenario, while by 2025, more waste is sent to MBT in the baseline than in the full implementation scenario, and vice versa for waste sent to landfill.

Figure 12 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025

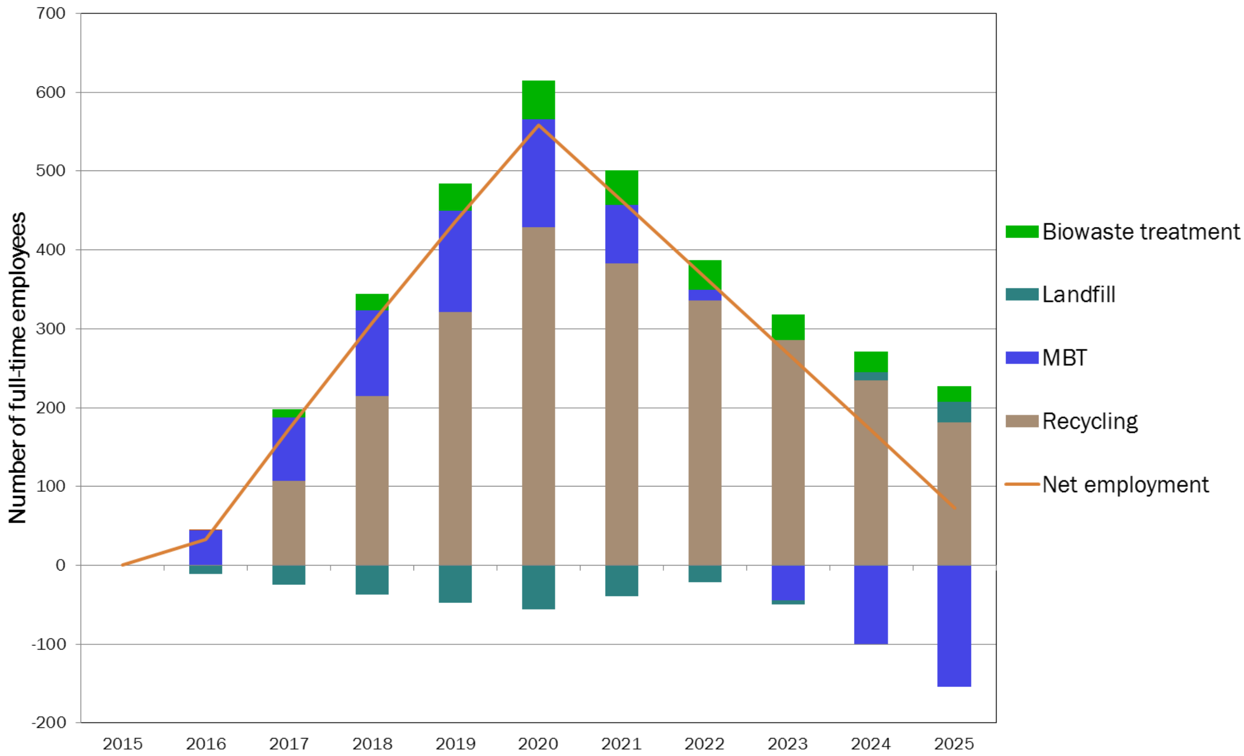


AQ: air quality
GHG: greenhouse gases

2.3.2 Employment

Figure 13 shows a net creation of additional full-time jobs under the full implementation scenario. While some jobs are lost at landfill sites up to 2022, more are created by recycling and in MBT plants (though switching again by the end of the time period). The difference in employment between the two scenarios diminishes after 2020, as does the difference in costs.

Figure 13 Differences in the number of full-time employees in the full implementation



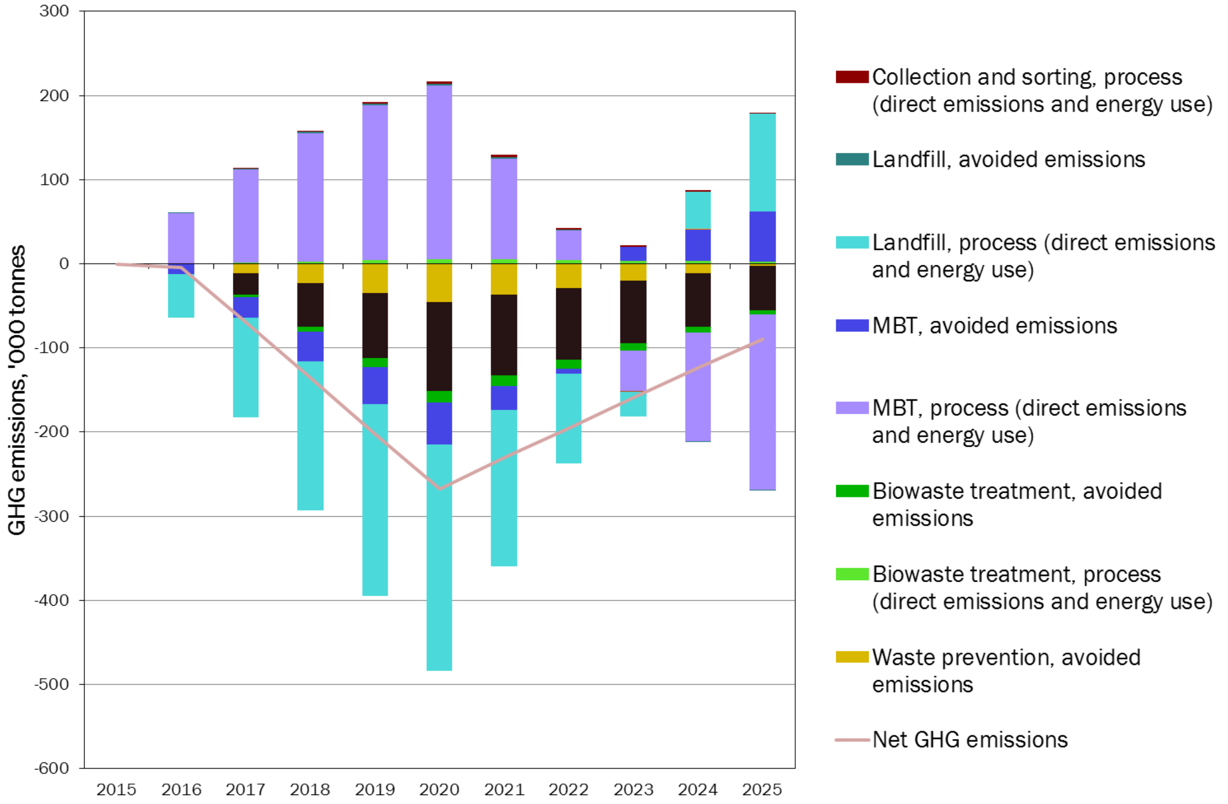
Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

2.3.3 Greenhouse gas emissions

Figure 14 shows a significant decrease in net GHG emissions in the full implementation scenario compared to the baseline. The largest amounts of avoided GHGs result from less MSW being sent to landfill and more recycling in the full implementation scenario until 2023[4], but process emissions from MBT are higher. Thereafter the differences diminish.

[4] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 14 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline scenario, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

2.3.4 Conclusion

Croatia is at risk of missing the WFD recycling target by 2020, illustrated by the modelled recycling rate of 31 per cent in 2020 and 43 per cent in 2025 in the baseline scenario.

Moving from the baseline to full implementation would result in an increased recycling rate and treatment in MBT and a sharp decline in landfill, as it is assumed in this scenario that the targets for diversion of biodegradable municipal waste from landfill are met according to the 1999 Landfill Directive (1999/31/EC).

The full implementation scenario would initially lead to increased costs, but there are net savings after 2024. It would also increase employment, mainly in recycling. There would be a net avoidance of externalities throughout the period.

3 Cyprus

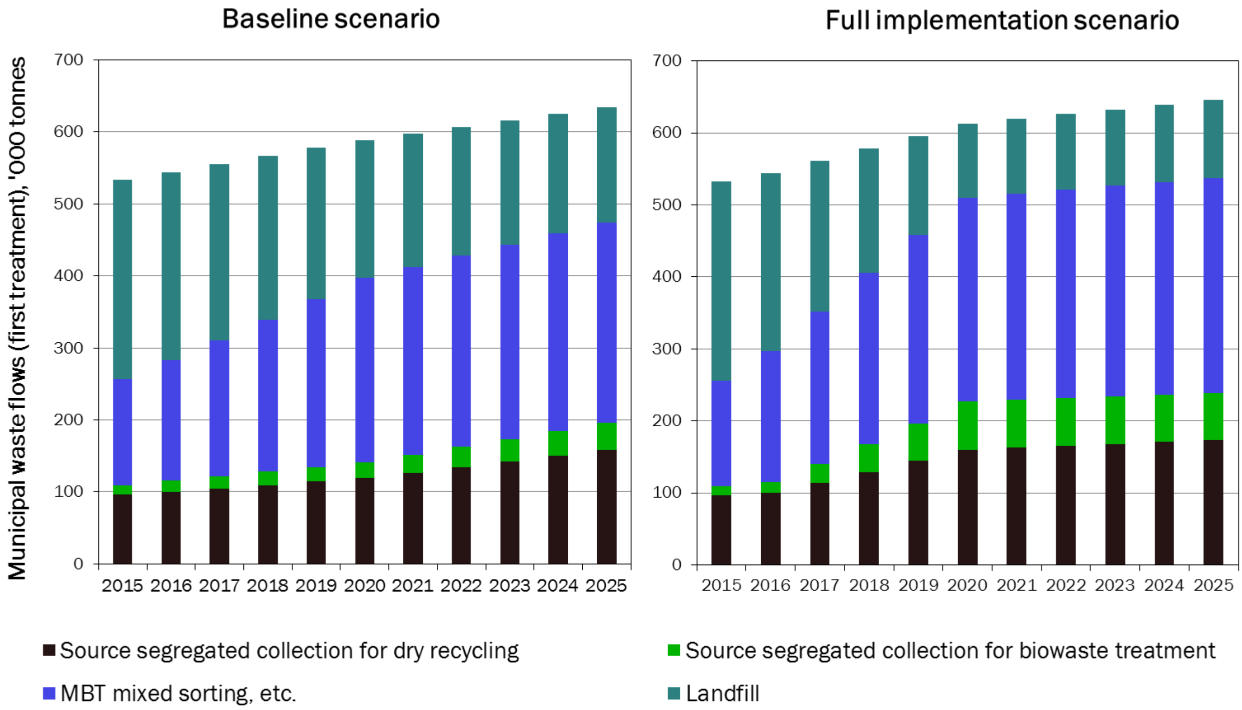
3.1 Development in the destinations of municipal solid waste

Figure 15 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios, revealing that overall waste generation is projected to increase in the time period 2015–2025.

The amount of waste Cyprus sends to landfill decreases in both scenarios, but more rapidly under full implementation. This difference is due to the need to comply with the target set by the Landfill Directive to divert biodegradable municipal waste from landfill.

The share of MSW separately collected for recycling and biowaste treatment increases in both scenarios, but more rapidly in the full implementation scenario in order to meet the 50 per cent recycling target of the WFD. MBT is also projected to increase in both scenarios.

Figure 15 Municipal solid waste destinations (first treatment), baseline and full implementation scenarios, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

3.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 6 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 2 Cyprus will achieve a recycling rate of 38 per cent by 2020. After 2020, the share is expected to increase further and to reach a 45 per cent in 2025, based on information about policy measures taking effect after 2020.

Table 6 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	32	33	34	35	36	38	39	41	42	44	45

Table 7 compares modelled calculations for the years 2013 and 2015 and reported data for the year 2013. The reported value in Table 7 refers to 2013 as no data were available for 2015. The recycling rate reported by Cyprus for 2013 is close to the one calculated by the model for the same year. A possible reason for the small difference might be variations in reject rates. By default, the model subtracts losses occurring during sorting of separately collected waste according to standard reject (loss) rates, and Cyprus might experience higher loss rates than those used in the model. Another reason might be differences between the model's assumed recycling efficiencies at MBT plants and the reality in Cyprus' MBT facilities. Finally, data provided by Cyprus in the questionnaire for the update of the model were not fully consistent so had to be adjusted, which in turn can influence the modelling results.

Table 7 Comparison of modelled calculations and Cyprus's reported recycling rates according to the chosen method, 2015

Method 2	2013	2015
Recycling rate calculated by the model (%)		32
Recycling rate calculated by the model (%) (2013)	29	
Reported recycling rate (%) (2013)	28	

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

Table 8 reports the amounts of waste generated and recycled in 2015, calculated according to the same principles.

Table 8 Comparison of modelled calculations and Cyprus's reported amounts of waste generated and recycled, 2015

Method 2	Generated	Recycled
Amounts calculated by the model ('000 tonnes)	245	79
Reported amounts ('000 tonnes) (2013)	245	68

Source of reported data: information made available by the European Commission; it includes data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

3.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Cyprus moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

3.3.1 Environmental externalities and financial costs

Figure 16 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Cyprus the costs related to the full implementation scenario are higher than for the baseline scenario, and that the net costs are driven by the financial costs.

As Cyprus moves from the baseline scenario towards the full implementation scenario, the difference in costs increases during the period 2015–2020, and then decreases significantly over the period 2020–2025 as the baseline moves closer to the full implementation scenario.

Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios decrease after 2020.

Figure 16 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

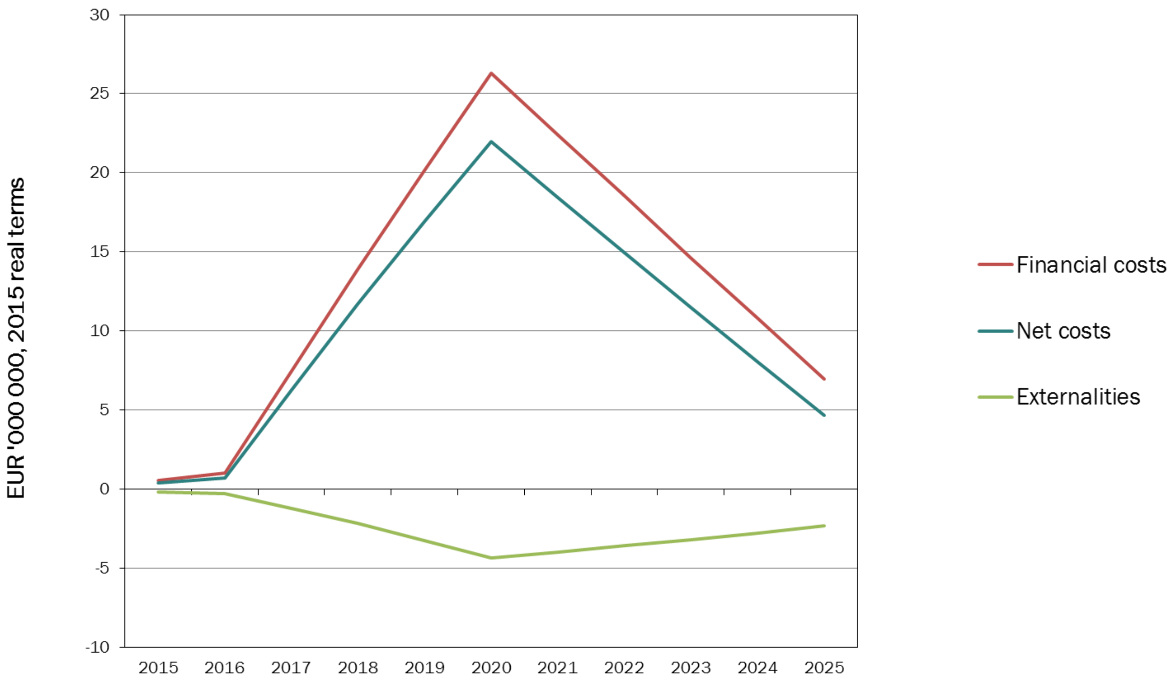
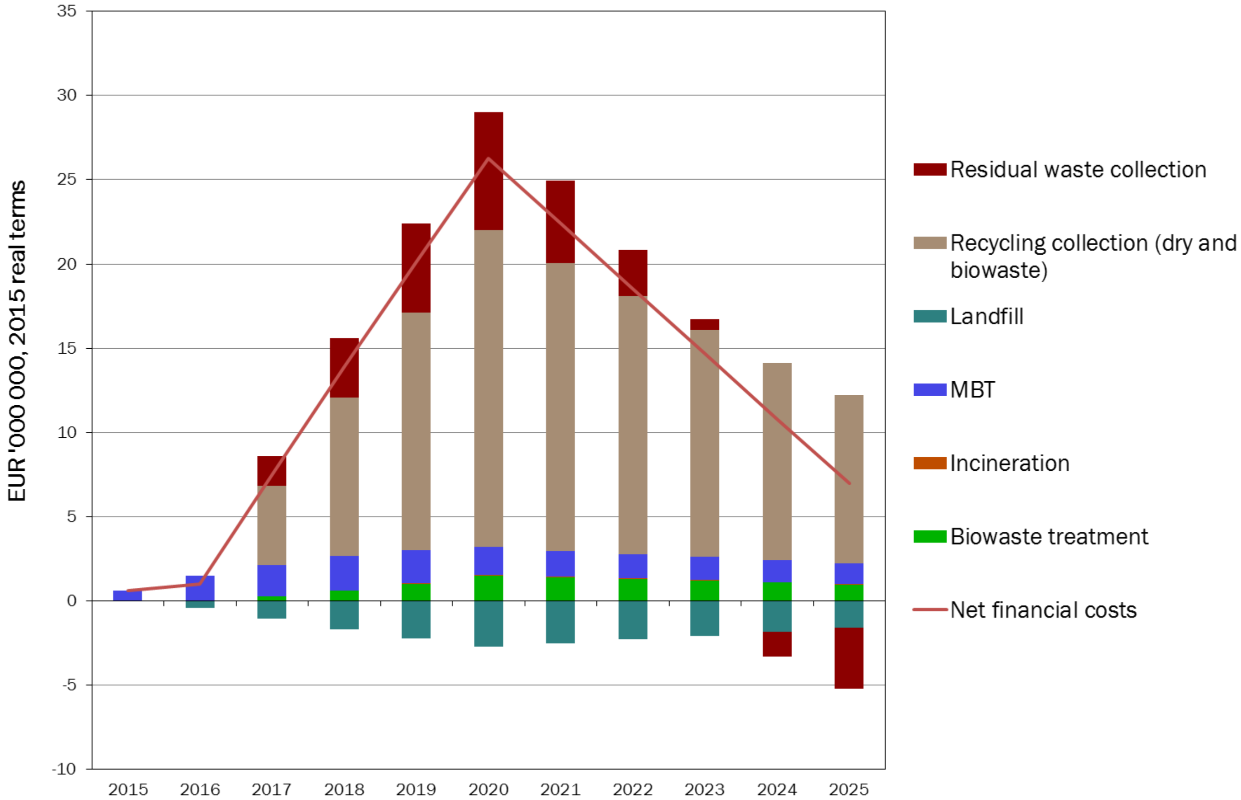


Figure 17 shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 16.

To reach the WFD target, the model assumes that a certain amount of waste is diverted from landfill to recycling, as shown in Figure 15. This results in lower landfill costs, and higher costs related to source-segregated collection for dry recycling and biowaste treatment in the full implementation scenario. Similarly, the costs for MBT and residual waste collection increase.
The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the difference in costs between the two scenarios

shrinks, as dry recycling increases under the baseline, while it remains (by definition) constant under full implementation. The same holds for biowaste treatment, even if its impact is smaller.

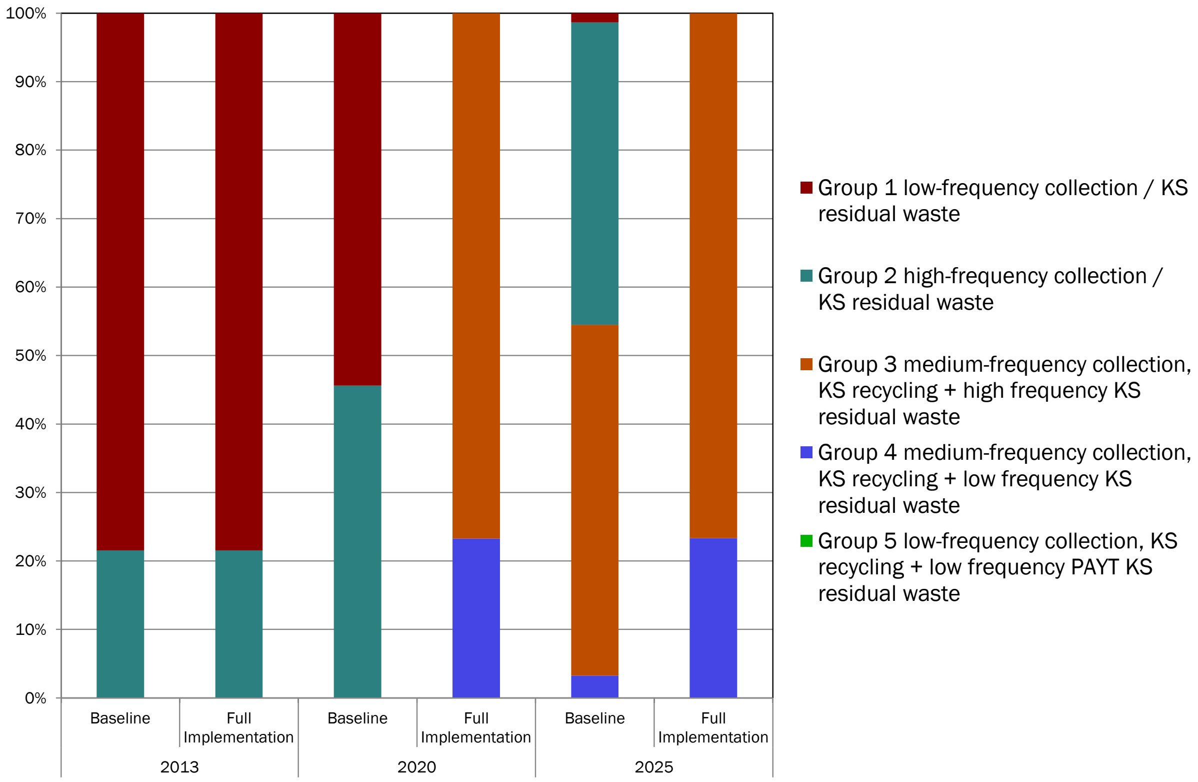
Figure 17 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 3 Cyprus' collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of residual waste collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Cyprus, the two scenarios imply a change from a combination of Groups 1 and 2 collection systems under the baseline to a combination of Groups 3 and 4 under full implementation. This difference is less pronounced in 2025.

Figure 18 Assumed collection systems for the baseline and full implementation scenarios, 2013, 2020 and 2025, % of households



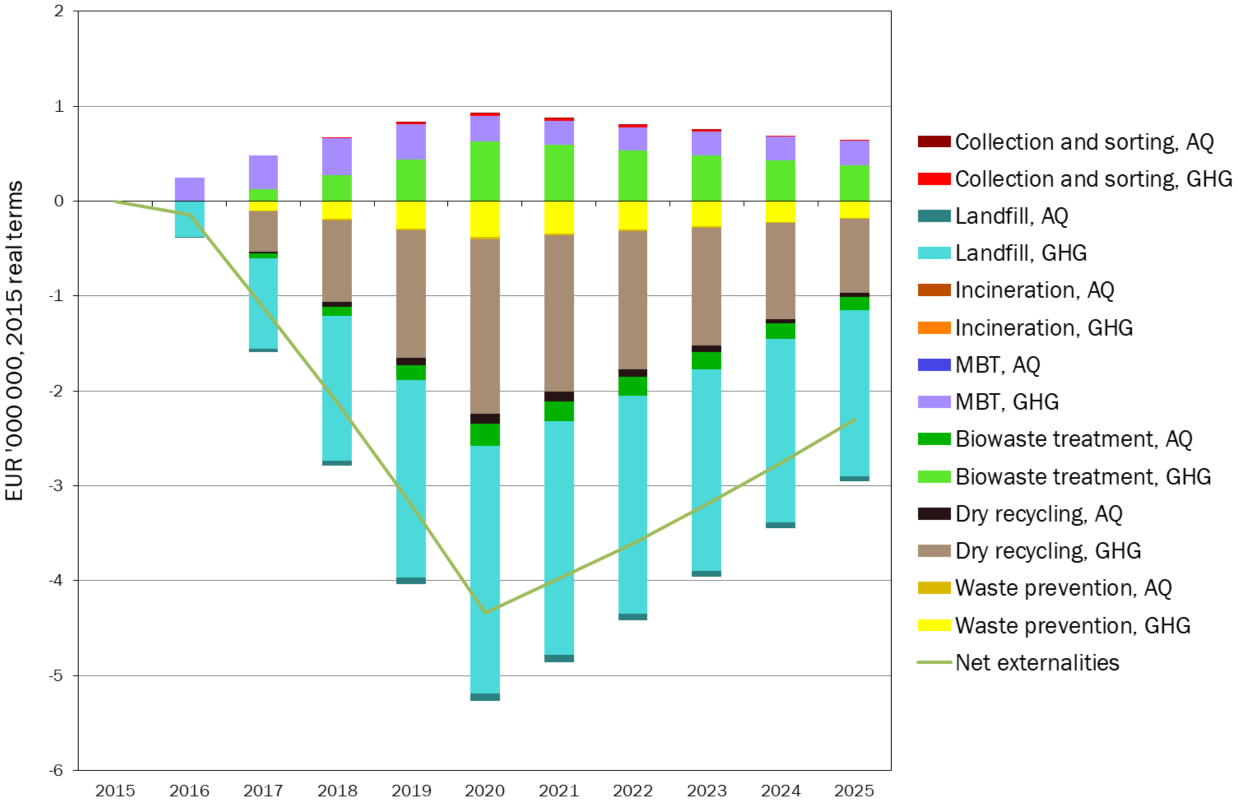
KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: [Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling].

Figure 19 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as those shown in Figure 16.

The graph shows avoided externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHG emissions from dry recycling and landfill in the full implementation scenario. There are, however, increased externalities caused by higher GHG emissions from biowaste treatment and MBT.

The maximum avoidance of externalities under full implementation in comparison with the baseline occurs in 2020. In the period 2020–2025, the difference shrinks because, as mentioned before, the difference in treatment between the scenarios decreases.

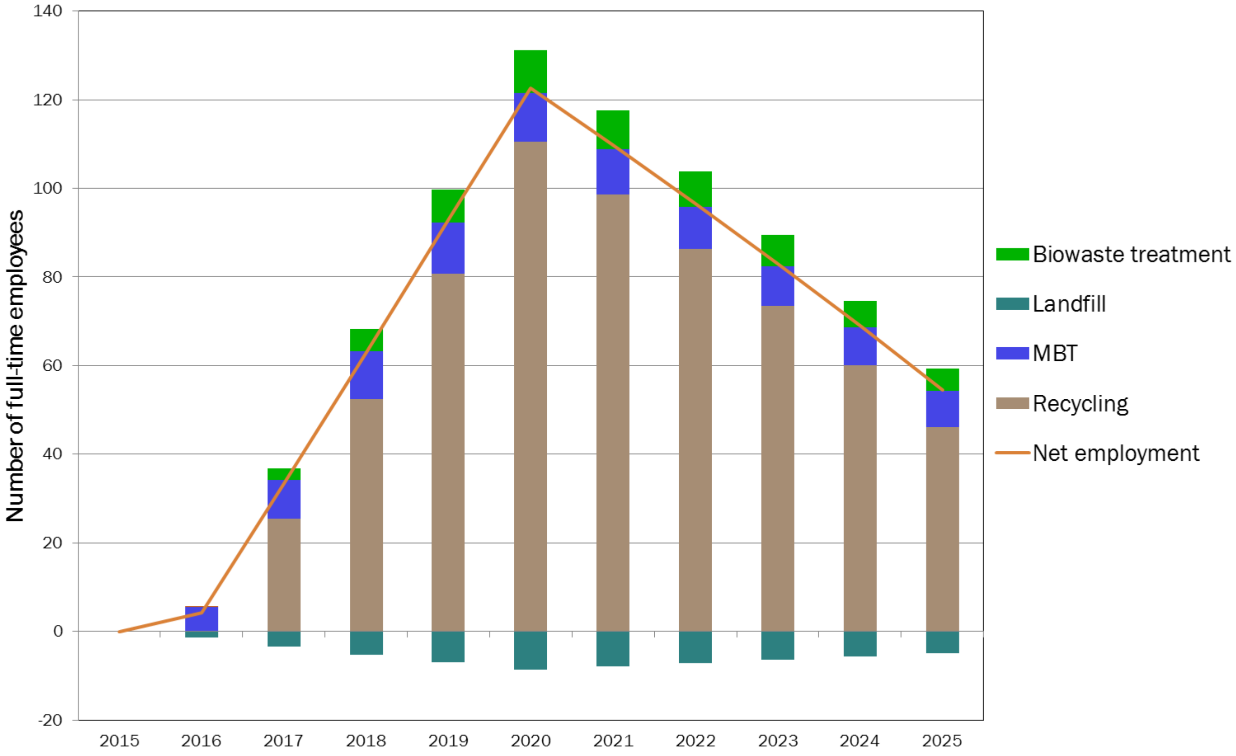
Figure 19 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



3.3.2 Employment

Figure 20 shows a net creation of additional employment under the full implementation scenario. Some jobs are lost at landfill sites but more are created through recycling activities (collection and processing), and at MBT and biowaste treatment facilities. The difference in employment between the two scenarios decreases after 2020, as do the costs.

Figure 20 Differences in the number of full-time employees in the full implementation scenario compared to the baseline, 2015–2025

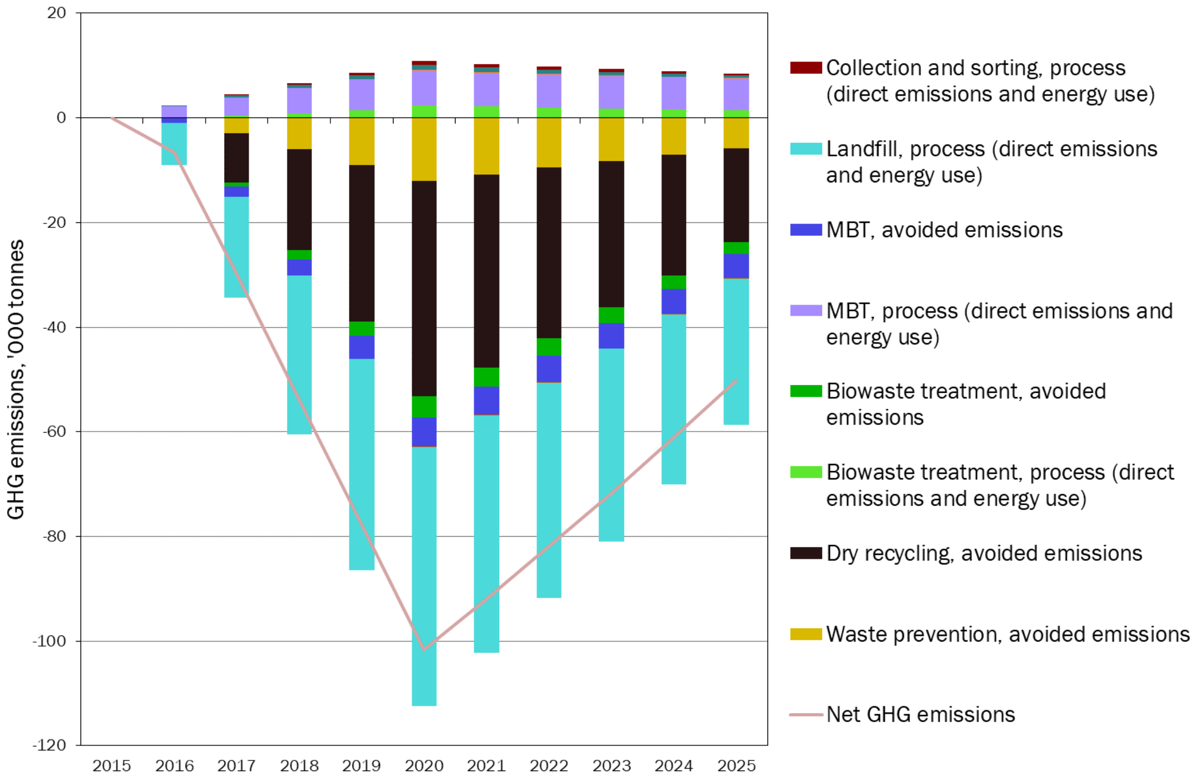


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

3.3.3 Greenhouse gas emissions

Figure 21 shows a significant decrease in net GHG emissions in the full implementation scenario compared to the baseline. The largest amounts of avoided GHGs come from less MSW being sent to landfill and more recycling in the full implementation scenario. The largest increase comes from process emissions from MBT. Overall, the net effect is positive for the environment.

Figure 21 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline scenario, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

3.3.4 Conclusion

Cyprus is at risk of missing the WFD recycling target by 2020, illustrated by the modelled recycling rate of 38 per cent in 2020 in the baseline scenario.

Moving from the baseline to full implementation would result in an increased recycling rate and more MBT. This implies a more complex collection system and, consequently, higher financial costs.

The full implementation scenario would increase employment, mainly in recycling. It would also reduce externalities.

4 Estonia

4.1 Development in the destinations of municipal solid waste

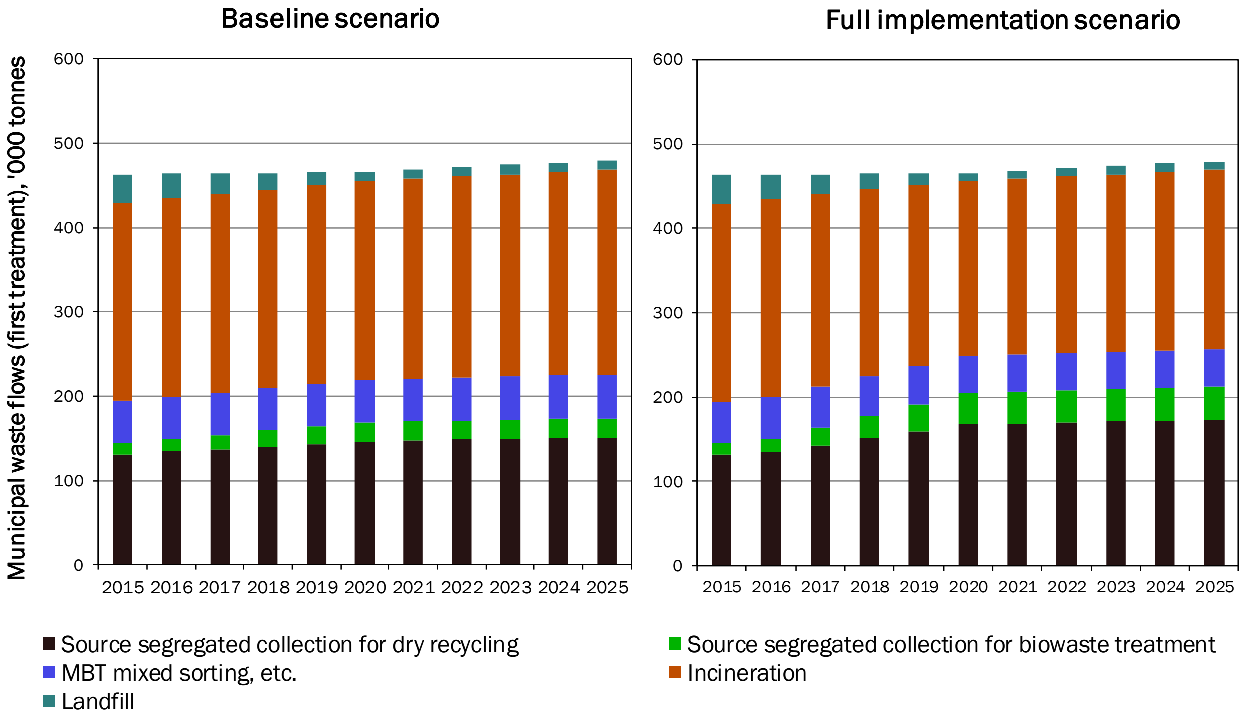
Figure 22 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

The ETC/WMGE has provided a waste generation projection for Estonia in which waste generation only increases slightly up to 2025.

Under the baseline scenario the amounts of waste collected for dry recycling and biowaste treatment only increase slightly, as the planned policy measures aimed at increasing recycling are considered to be rather uncertain. Thus, in this scenario, Estonia will not reach the WFD 50 per cent recycling target. Under the full implementation scenario, to meet the recycling target, the share of waste collected for dry recycling and biowaste treatment will increase up to 2020. Thereafter, the full implementation scenario remains constant because the targets have been reached in 2020, and the baseline scenario does not change after 2020 because there are no indications of policy measures or new capacity thereafter.

In the baseline scenario, it is assumed that the shares of MSW sent to MBT and incineration are left unchanged because the existing capacities can be expected to be used, and that recycling is slightly increased at the expense of landfill. In the full implementation scenario, the needed increase in waste collected for recycling and biowaste treatment is only possible when the shares of MBT and incineration decrease.

Figure 22 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

4.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 9 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 2 Estonia will achieve a recycling rate of 45 per cent by 2020 with no further increase to 2025, and will thus miss the WFD target. As no further policy measures are known to be firmly planned after 2020, the baseline scenario does not assume further changes to waste management after 2020, so the recycling rate stays constant until 2025. This is of course pessimistic, and Estonia might be expected to plan additional measures if it falls short of the 2020 WFD target. However, such measures are not known so are not included in the baseline scenario.

Table 9 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	41	41	42	43	43	45	45	45	45	45	45
Customised recycling rate (%)	30	31	32	33	34	35	35	35	35	35	35

Table 10 compares modelled calculations and reported data. The recycling rate reported by Estonia, which uses Method 2, differs from the recycling rate calculated by the model. By default, the model makes assumptions about which waste fractions are included in the recycling rate, which may differ from the fractions used by the Member State. Estonia has chosen to use more fractions than those the model uses as a default, resulting in a significantly lower recycling rate than the default Method 2 calculations made by the model (Table 9). Estonia's customised method is very similar to Method 4.

In addition, the model calculates the recycling rate by applying a set of reject rates (losses) to the collected amounts. Member States might have differing reject rates. Another reason for the difference between reported and calculated recycling rates in 2015 might be that the data on amounts collected for biowaste treatment provided by Estonia were not fully consistent, so required slight adjustment for the model. However, even with the recycling rate reported by Estonia for the year 2015 and the same percentage point increase in recycling up to 2020 as in the baseline scenario, Estonia is at risk of missing the 50 per cent recycling target of the WFD.

Table 10 Comparison of modelled calculations and Estonia's reported recycling rates according to the chosen method, 2015

Method 2	2015
Recycling rate calculated by the model (%)	41
Recycling rate calculated using customised method (%)	30
Reported recycling rate (%)	33

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

4.3 Impacts related to municipal solid waste management

All the following graphs show the changes in impacts that would occur if Estonia moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

4.3.1 Environmental externalities and financial costs

Figure 23 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Estonia the net costs related to the full implementation scenario are lower than those related to the baseline scenario, and that these are driven by the financial costs. As Estonia moves from the baseline scenario towards full implementation between 2015 and 2020, the difference in costs increases. Developments after 2020 are solely driven by the slight increase in generated waste, as both scenarios otherwise stay constant.

The reduction in incineration up to 2020 for the full implementation scenario results in lower externalities for this scenario, enabling environmental benefits to be realised when moving to full implementation.

Figure 23 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

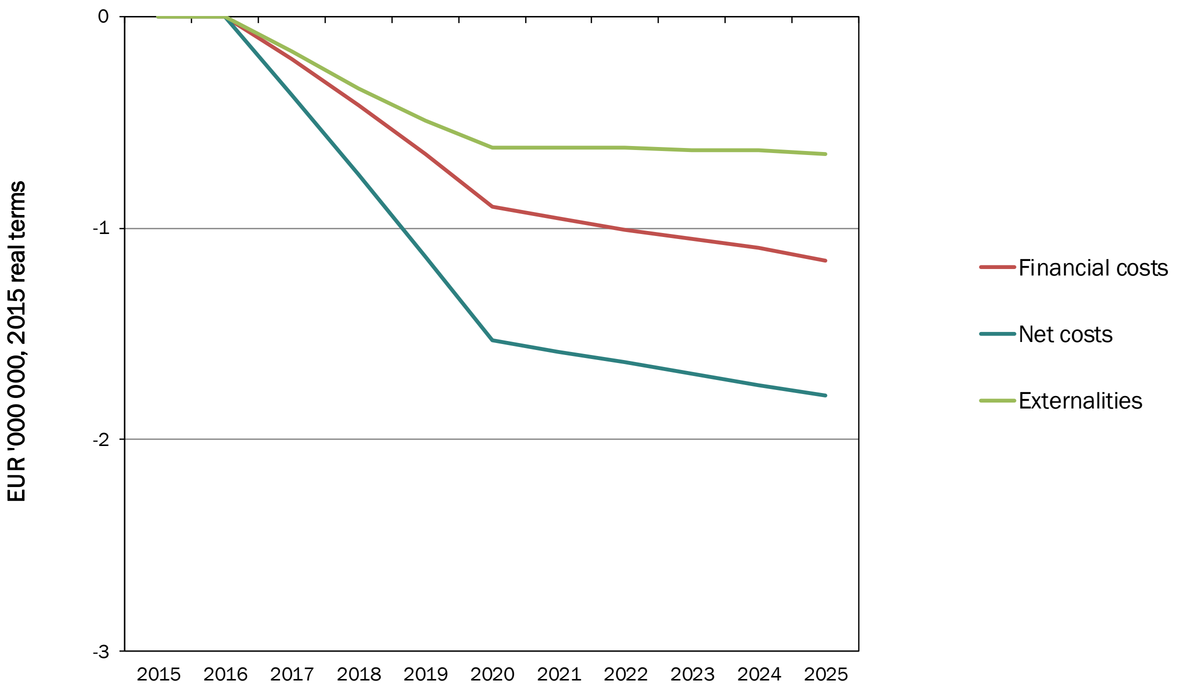


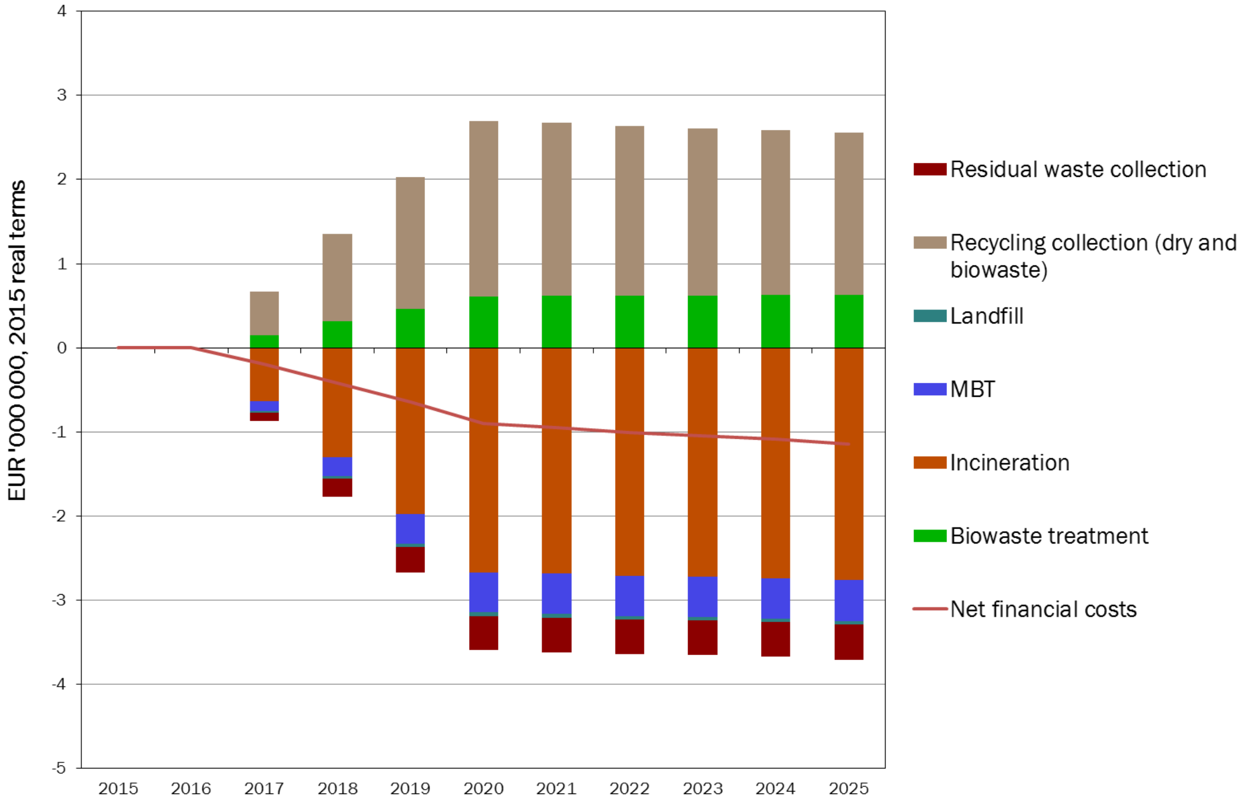
Figure 24Figure shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown shown in Figure 23

The lower incineration rate is the main driver for the reduced financial costs of the full implementation scenario. As the baseline scenario indicates higher amounts of waste sent to MBT than the full implementation scenario, there are cost savings related to MBT treatment for the full implementation scenario. Reduced residual waste generation in the full implementation scenario also results in lower costs for residual waste collection.

The increased collection for recycling when moving from the baseline scenario to full implementation results in higher costs for collection for recycling. Increased biowaste treatment for the full implementation scenario also results in higher costs.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the difference stagnates as both the baseline and full implementation scenario remain stable as of 2020 (see also Box 4).

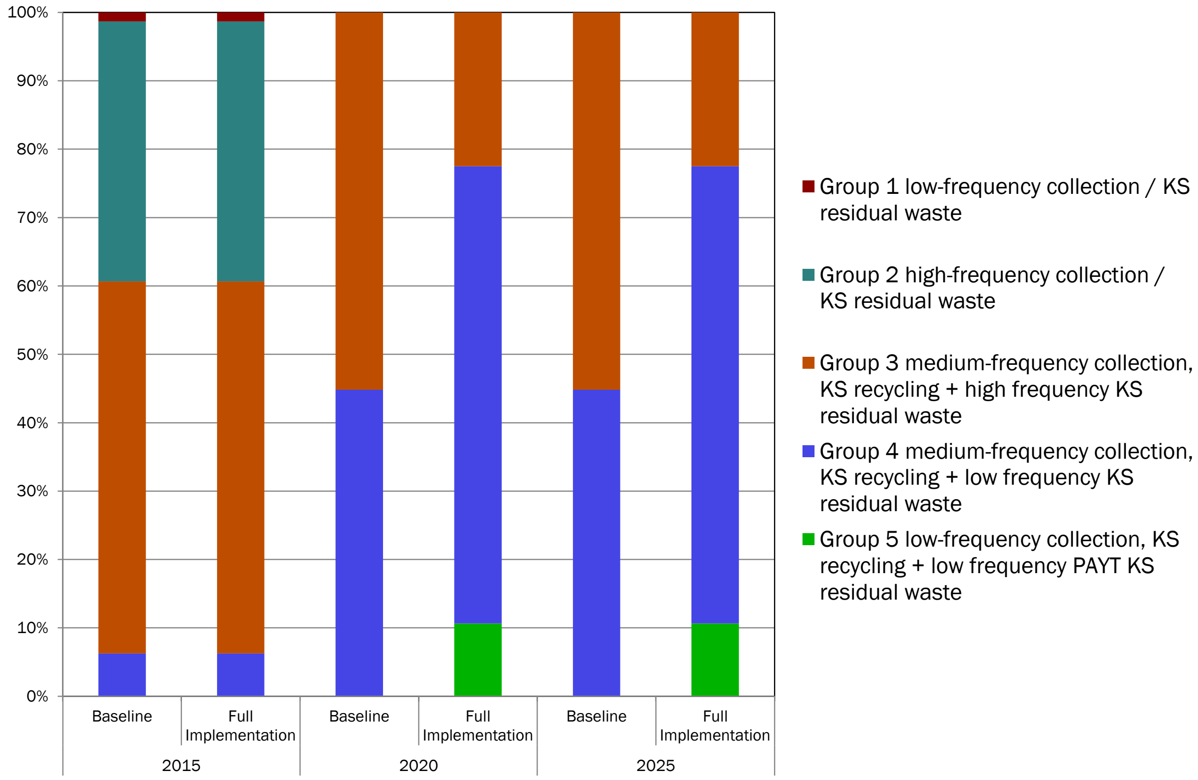
Figure 24 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 4 Estonia's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Estonia, although the differences in recycling rates between the two scenarios are relatively small, the model assumes a change from a combination of Groups 2 and 3 with a bit of Groups 1 and 4, to a combination of Groups 3 and 4 for the baseline when increasing the recycling rates, and including Group 5 in the full implementation scenario. The collection systems remain the same between 2020 and 2025 as the baseline and full implementation scenarios for Estonia remain the same after 2020.

Figure 25 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



KS: kerbside collection

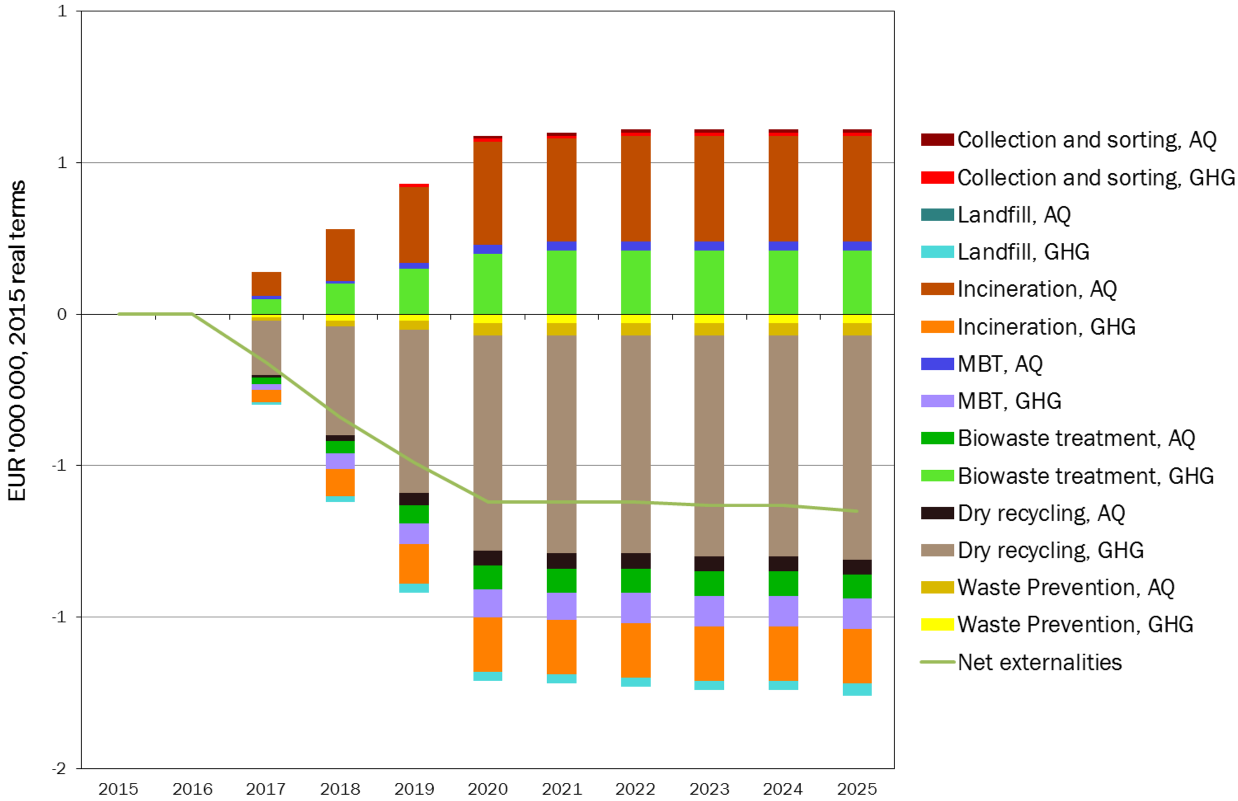
PAYT: pay as you throw

Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 26 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as in Figure 23Figure .

The graph shows a net avoidance of externalities in the full implementation scenario. This result is mainly driven by avoided GHG emissions from dry recycling[5], and increased air pollutants from incineration[6].

Figure 26 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



4.3.2 Employment

Figure 27 shows a net creation of additional employment under the full implementation scenario. While some jobs are lost at incineration and MBT sites, significantly more are created by the increase in recycling.

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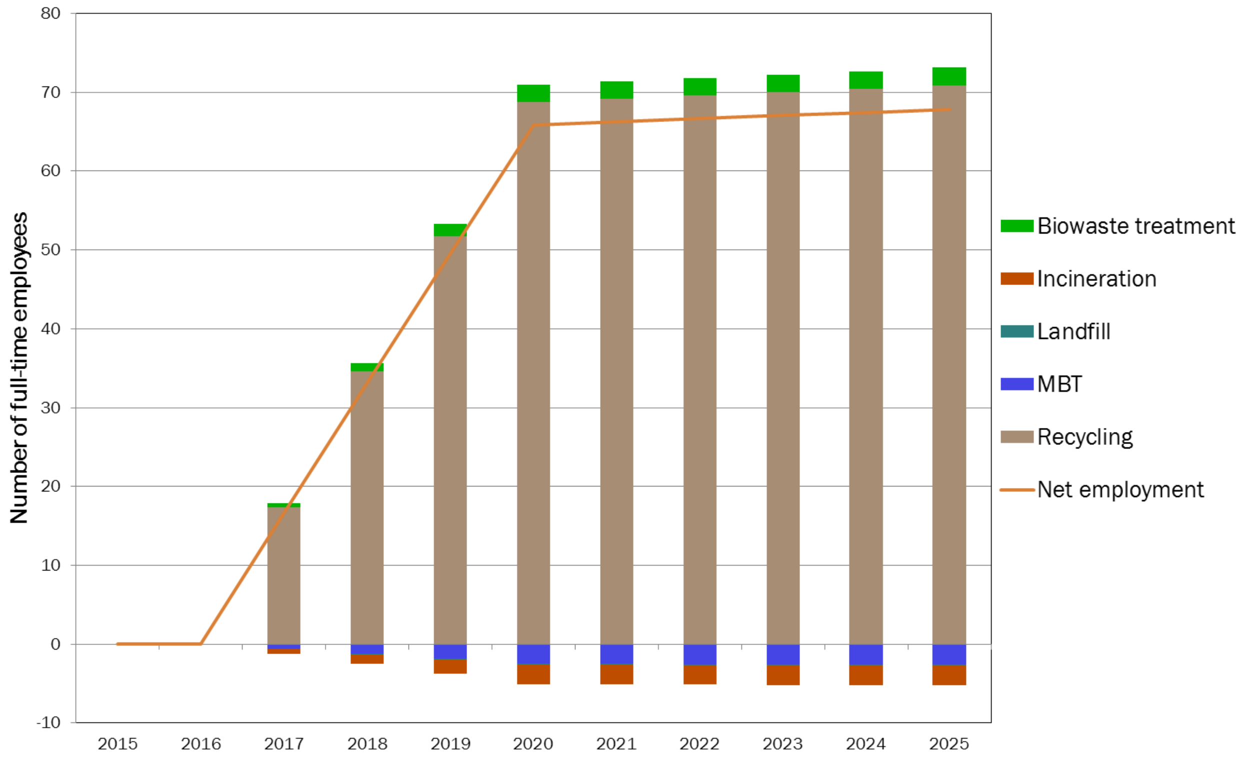
[5] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

[6] The increased air pollutants from incineration are related to the avoided emissions from waste incineration and consequent emissions from other fuels. If the alternative energy mix has higher emissions than waste incineration, the emissions are increased although the waste incineration is reduced.

Figure 27 Differences in the number of full-time employees in the full implementation

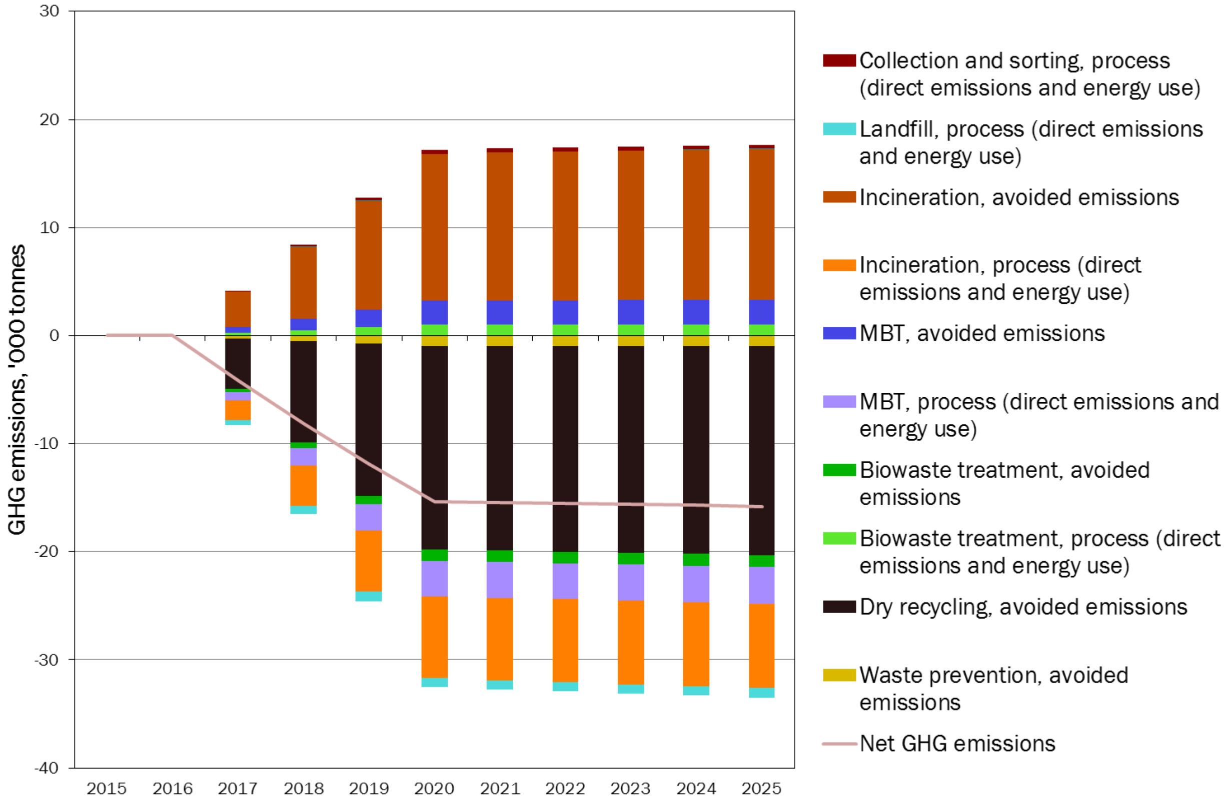


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

4.3.3 Greenhouse gas emissions

Figure 28 shows a small decrease in net GHG emissions in the full implementation scenario up to 2020, as the baseline scenario moves towards the full implementation scenario. The change is largely driven by avoided emissions from dry recycling. Greenhouse gas emissions from incineration (process emissions) decrease because less waste is incinerated in the full implementation scenario. At the same time, incineration generates energy that replaces energy from other sources and thus avoids GHG emissions. Less incineration in the full implementation scenario compared to the baseline scenario thus results in fewer direct emissions and fewer avoided emissions.

Figure 28 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

4.3.4 Conclusion

Estonia is at risk of missing the 2020 WFD recycling target, illustrated by a modelled increased recycling rate of 5 per cent between 2015 and 2020, ending up at a modelled recycling rate of 35 per cent in 2020. If the 5 per cent increase is applied to the reported 33 per cent, Estonia would end up at 38 per cent, still missing the 2020 WFD target. Estonia has chosen to calculate the recycling rate by including more fractions than those the model uses as a default, resulting in a significantly lower recycling rate than the model's default Method 2 calculations.

In order to achieve the target by 2020, Estonia will have to increase recycling and to send less MSW to incineration and/or MBT.

The full implementation scenario would bring a small decrease in externalities, reduced financial costs and increased employment, mainly in recycling. However, the reduction in financial costs in the modelled results is mainly due to lower incineration costs, while in reality, incineration capacities will not be reduced. Such cost reductions will then only be realised if imports or other (non-municipal) waste fill the available incineration capacity.

5 Finland

5.1 Development in the destinations of municipal solid waste

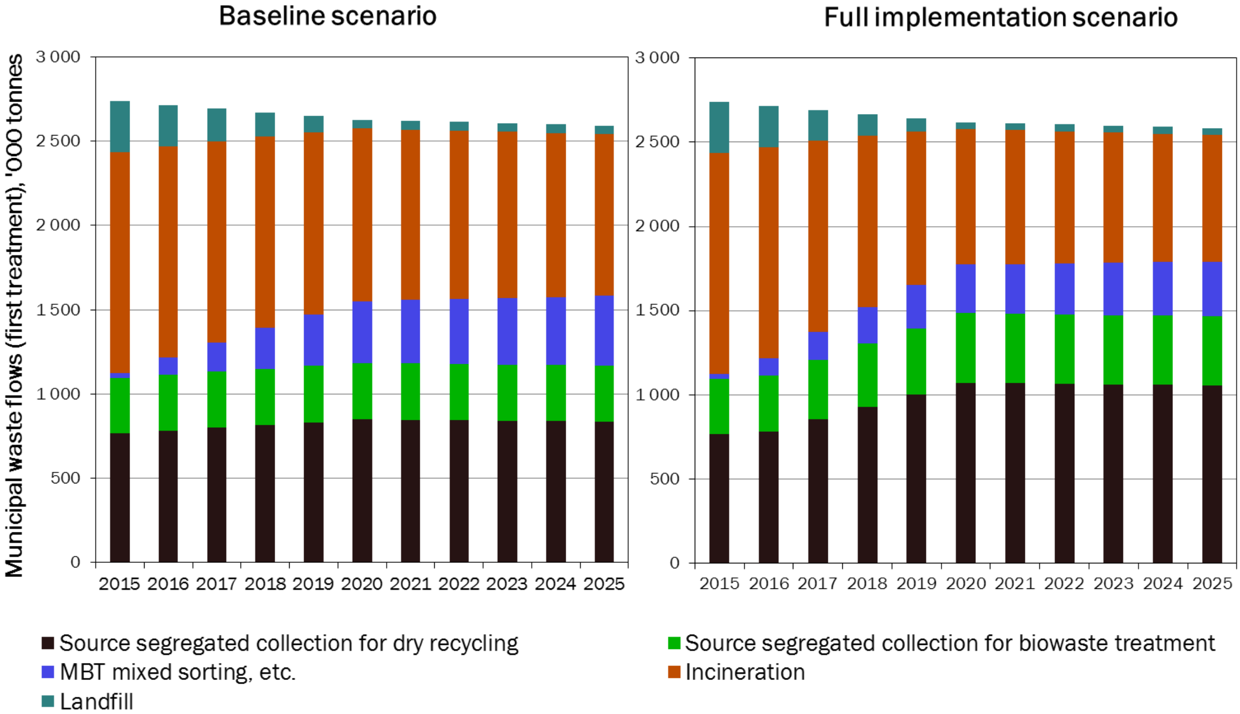
Figure 29 shows the direct inputs to different types of waste treatment for the baseline and full implementation scenarios.

The ETC/WMGE projection provided for Finland assumes a slight reduction in waste generation during 2015–2025.

Under the baseline scenario, the amounts of waste collected for dry recycling and biowaste treatment will only increase slightly, as the planned policy measures to increase recycling are considered to be rather uncertain. Under the baseline scenario Finland would not reach the 50 per cent recycling target of the WFD. Under the full implementation scenario, the share of waste collected for dry recycling as well as biowaste collection will increase to meet the recycling target.

Under both scenarios the amount of waste Finland sends to landfill and incineration will decrease. The reduction in landfill is very similar under the two scenarios, while the expected reduction in the amount sent to incineration is more significant under the full implementation scenario. The larger reduction in incineration in the full implementation scenario results from increased rates of material recycling, driven by the 2020 WFD recycling target. As Finland is building additional MBT capacity, the share sent to MBT increases in the baseline scenario; it also increases in the full implementation scenario, but by less.

Figure 29 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

5.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 11 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 4 Finland will achieve a recycling rate of 40 per cent by 2020 with no further increase to 2025. This is, of course, a pessimistic view, and Finland might be expected to plan additional measures if it falls short of the target in 2020. However, these are not known and are thus not included in the baseline scenario.

Finland has reported that it does not subtract rejects from reported recycling rates. Following this method, Finland would achieve a 46 per cent recycling rate by 2020.

Table 11 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	36	37	38	39	39	40	40	40	40	40	40
Recycling rate without subtracting rejects (%)	40	41	42	43	45	46	46	46	46	46	46

Table 12 compares modelled calculations and reported data. The model calculates the recycling rate by applying a set of reject rates (losses) to the collected amounts. Member States might have differing reject rates, or may report the recycling rate based on separately collected waste. If reject rates are not subtracted for 2015, the model arrives at the same recycling rate as that reported by Finland.

Table 12 Comparison of modelled calculations and Finland's reported recycling rates according to the chosen method, 2015

Method 4	2015
Recycling rate calculated by the model (%)	36
Recycling rate calculated by the model without subtracting rejects (%)	40
Reported recycling rate (%)	40

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation.

5.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Finland moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

5.3.1 Environmental externalities and financial costs

Figure 30 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHG and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Finland the costs related to the full implementation scenario are lower than those for the baseline scenario, and that the net costs are driven by the financial costs. As Finland moves from the baseline scenario towards full implementation between 2016 and 2020, the difference in costs increases. The small changes after 2020 are due to the slightly decreasing waste generation.

Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios diminish after 2020, driven by the slight decrease in waste generation.

Figure 30 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

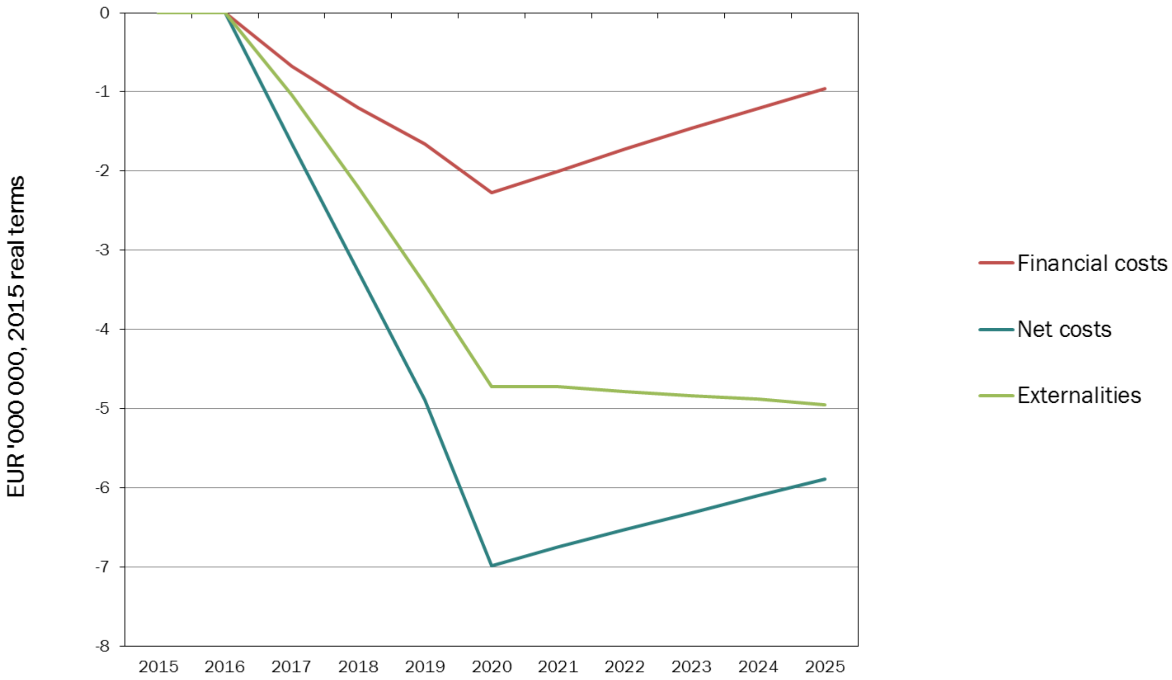


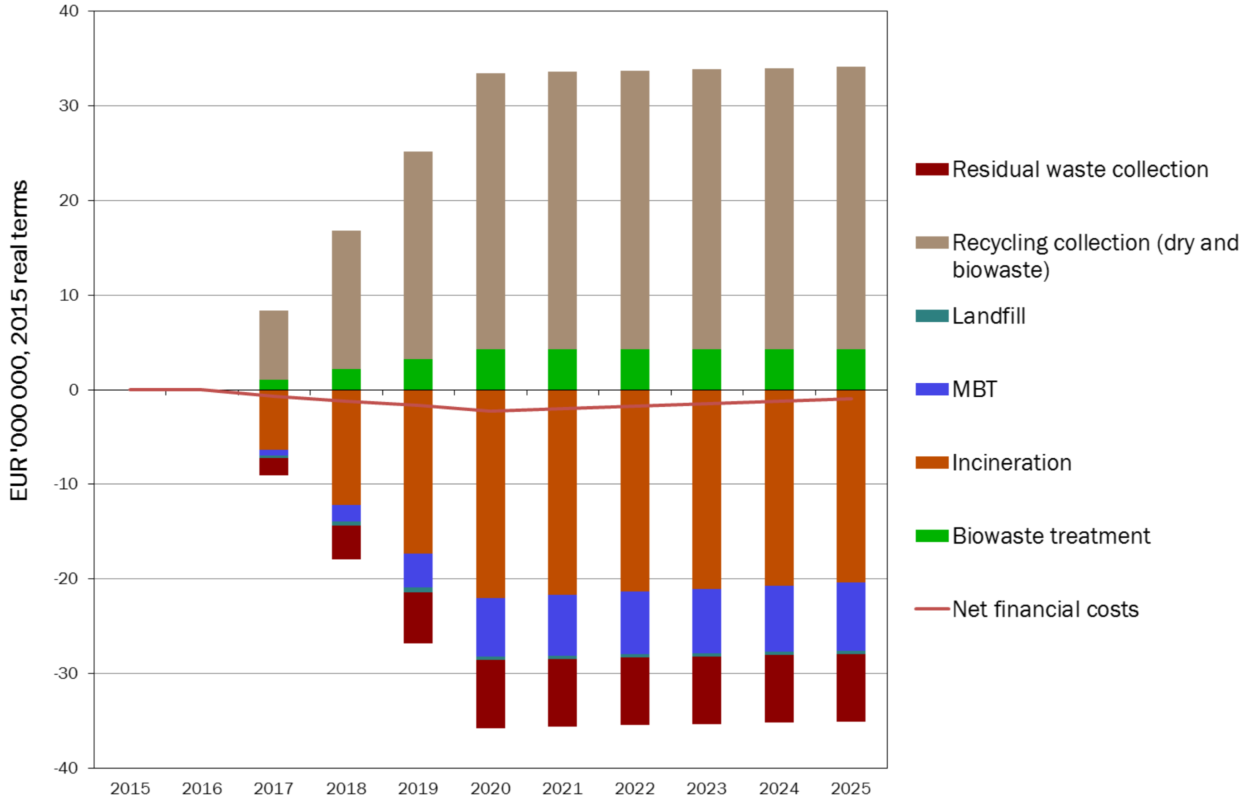
Figure 31 shows the split in financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 30.

The increased collection for recycling when moving from the baseline scenario results in higher costs for collection for recycling and lower costs for residual waste collection (see also Box 5). Increased biowaste treatment in the full implementation scenario also results in higher costs.

The baseline scenario indicates higher amounts of waste being sent to MBT and incineration than the full implementation scenario, which is why there are cost savings related to MBT treatment and incineration in the full implementation scenario.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the difference stagnates as both the baseline and full implementation scenarios remain stable. The small changes after 2020 are due to the slightly decreasing waste generation.

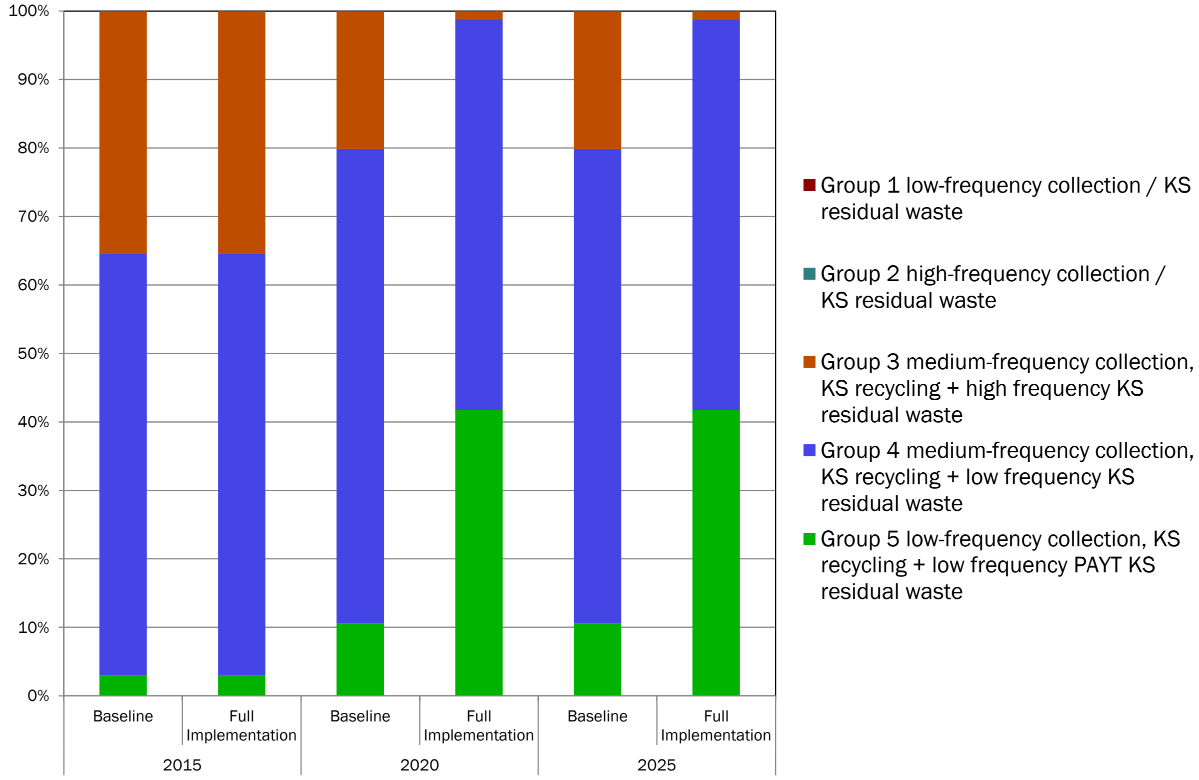
Figure 31 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 5 Finland's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Finland, although the differences in recycling rates between the two scenarios are relatively small, the model assumes a change from a combination of mainly Group 4 with some from Groups 3 and 5, to a combination of mainly Groups 4 and 5 when moving from the baseline to full implementation. The systems do not change after 2020, as both scenarios for Finland remain the same after 2020.

Figure 32 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households

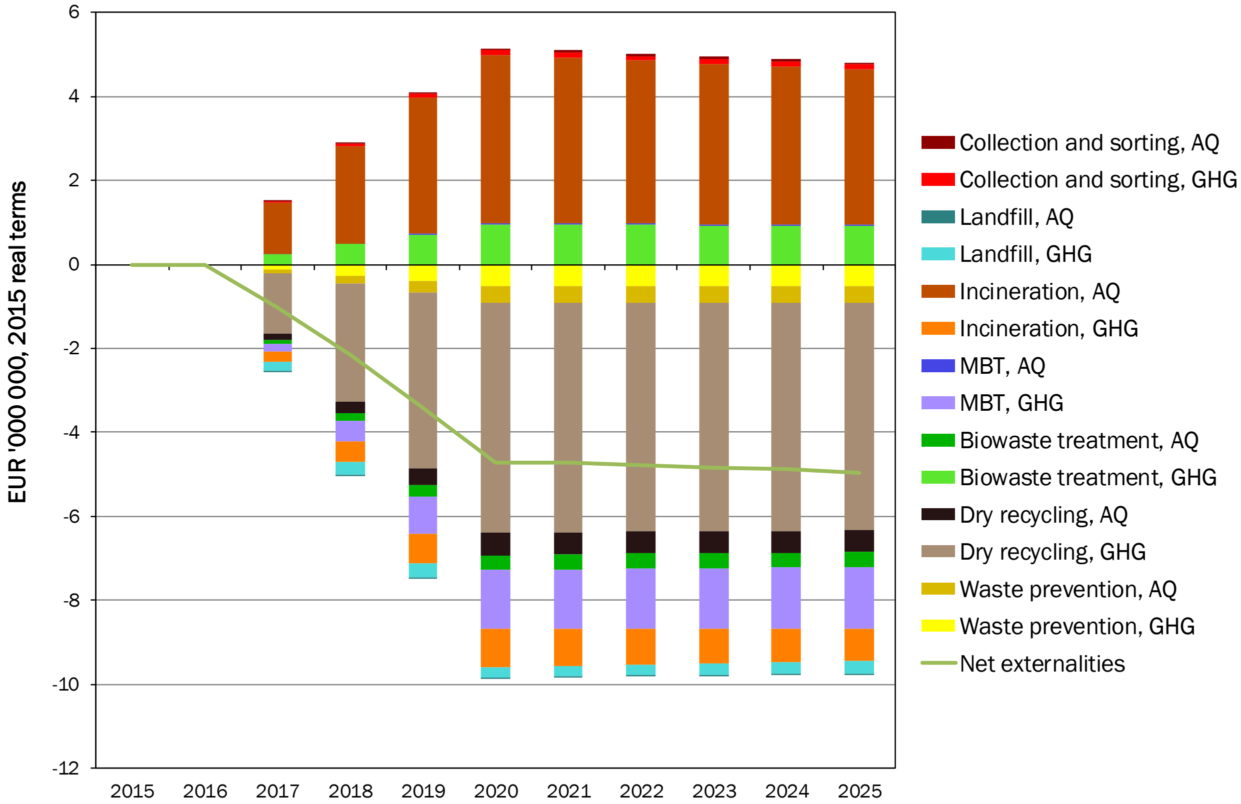


KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 33 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as in Figure 30.

The graph shows avoided externalities in the full implementation scenario compared to the baseline. This result is mainly driven by avoided GHG emissions from recycling in the full implementation scenario[7], but also by waste prevention, MBT, incineration and landfill. In addition, avoided externalities related to emissions of air pollutants from landfill, MBT, biowaste treatment and recycling influence this result. There are, however, externalities caused by higher GHG emissions from biowaste treatment and by air pollutants from incineration in the full implementation scenario. The latter seems to be counterintuitive, but can be explained by the assumption in the model that energy from waste incineration replaces dirtier energy from other sources in Finland. The small waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste leads to higher awareness of citizens on food waste.

Figure 33 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline scenario, 2015–2025

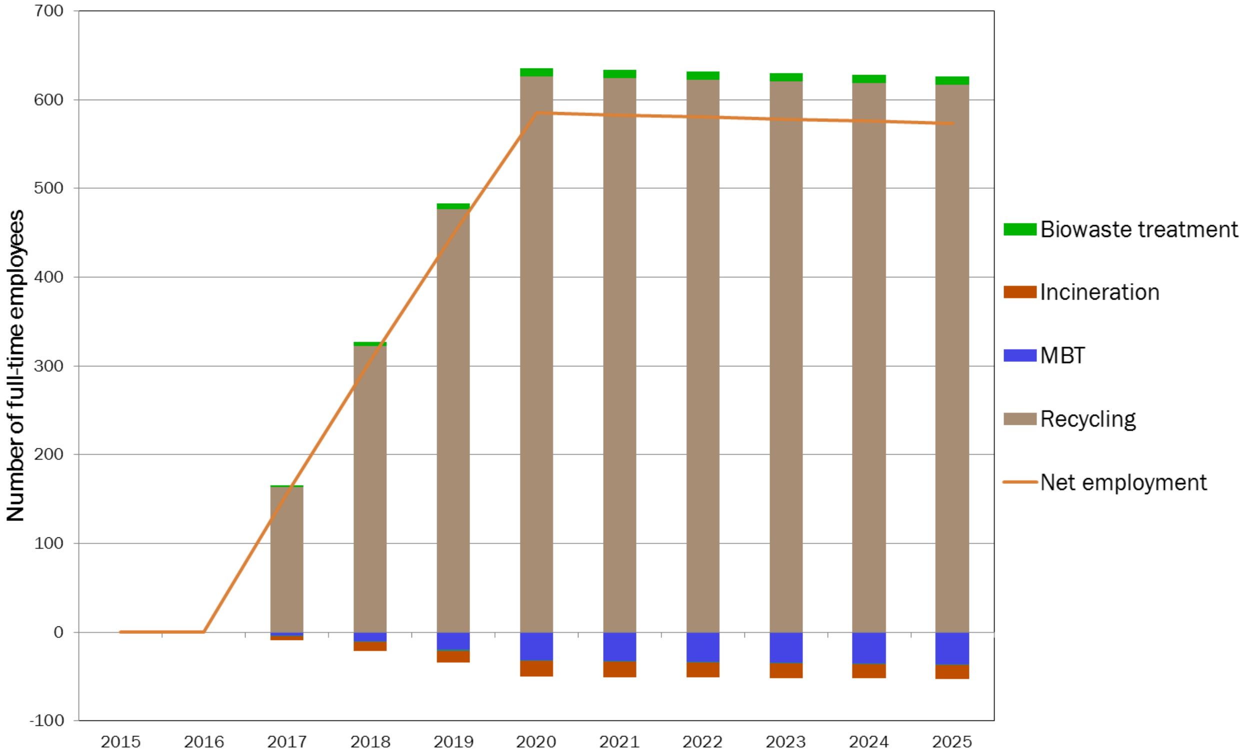


5.3.2 Employment

Figure 34 shows a net creation of additional employment under the full implementation scenario. While some jobs are lost in MBT and incineration facilities, more are created through the increase in dry recycling.

[7] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 34 Differences in the number of full-time employees in the full implementation

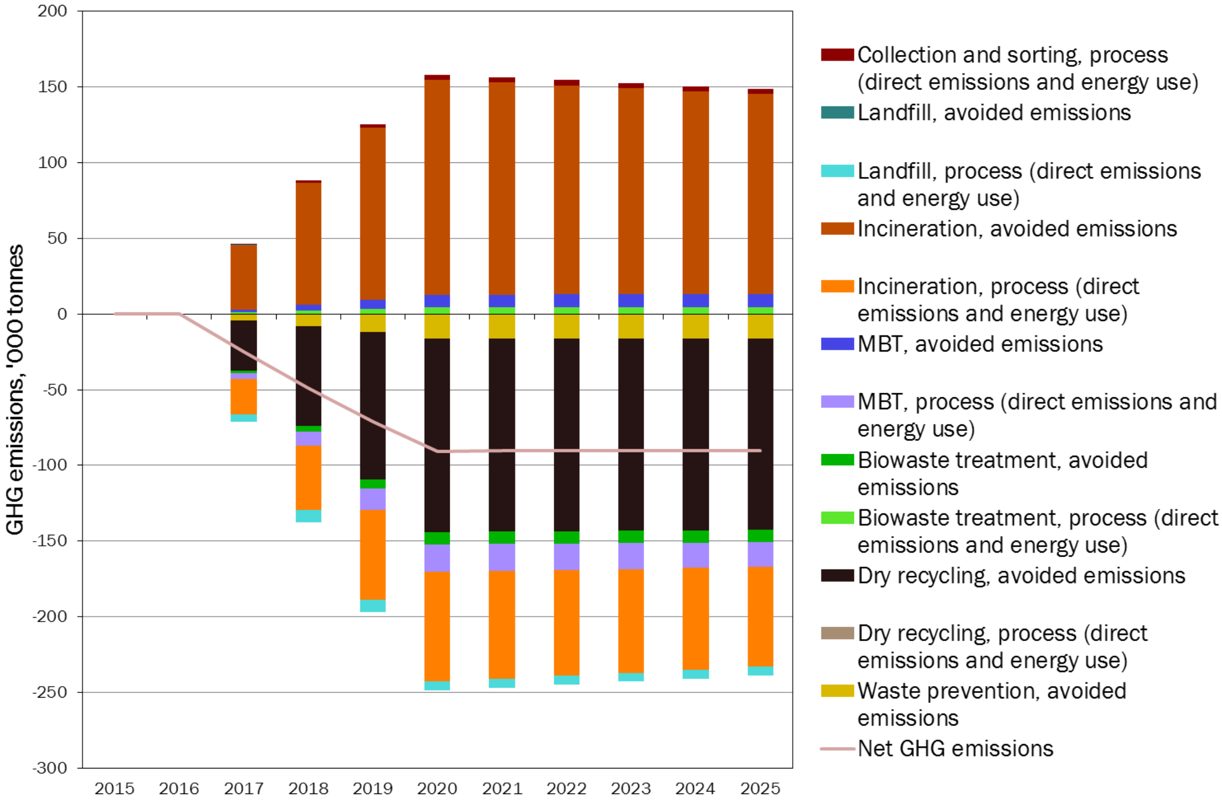


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

5.3.3 Greenhouse gas emissions

Figure 35 shows a significant decrease in GHG emissions in the full implementation scenario. The largest amounts of avoided GHGs come from increased dry recycling. Emissions from incineration, MBT, biowaste treatment and avoided landfill are also lower. Incineration generates direct GHG emissions from incineration plants, but generates energy that replaces energy from other sources and thus avoids GHG emissions. Less incineration in the full implementation scenario results in fewer direct emissions and fewer avoided emissions. The small changes after 2020 are due to the slightly decreasing amounts of MSW generated.

Figure 35 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

5.3.4 Conclusion

Finland is at risk of missing the 2020 WFD recycling target, illustrated by a modelled recycling rate of 40 per cent in 2020 (46 per cent when rejects are not subtracted) in the baseline scenario.

Moving from the baseline to full implementation would result in an increased recycling rate, while incineration and MBT would decrease.

The full implementation scenario would bring about a reduction in externalities and financial costs while increasing employment, mainly in recycling.

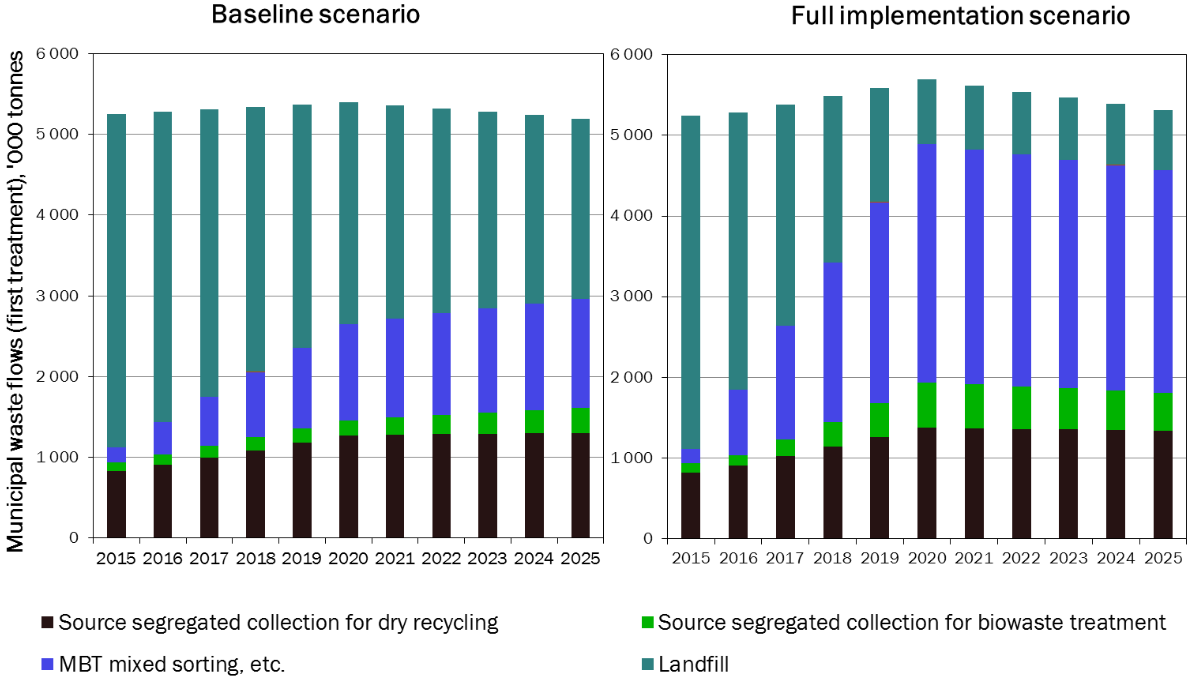
6 Greece

6.1 Development in the destinations of municipal solid waste

Figure 36 shows the direct inputs to different types of treatment for the baseline and the full implementation scenario.

The amount of waste Greece sends to landfill shows a completely different trend across the two scenarios. Although in the baseline scenario landfilling decreases, under full implementation it is drastically reduced to comply with the binding diversion target of the EU Landfill Directive, which requires Greece, by 2020, to reduce landfill of BMW to 35 per cent of the amount generated in 1995. To compensate for this massive reduction, MBT increases significantly under full implementation, while less significant changes take place in collection for dry recycling and biowaste treatment.

Figure 36 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

6.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 13 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 2 Greece will achieve a recycling rate of

42 per cent by 2020. After 2020, the share is expected to increase further and to reach 47 per cent in 2025 due to planned policies.

Table 13 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	26	29	32	36	39	42	43	44	45	46	47
Recycling rate (%), customised	26	29	31	34	36	38	40	41	43	45	46

Table 14 compares modelled calculations and reported data for 2015. The recycling rate reported by Greece matches the model's calculation.
To calculate future recycling rates the model uses average material capture rates in combination with actual country specific capture rates per material group. If a country plans to implement a collection system for materials for which there is currently no separate collection, or if this new system will influence the balance between separate collection of biowaste and dry recyclables, the future recycling rates calculated by the model will not reflect the actual plans of the country. To better reflect the actual plans of Greece regarding the introduction of separate collection for biowaste, a customised calculation was done which takes into account these efforts. The results of these customised calculations are shown in Table 13 in the bottom row.

Table 14 Comparison of modelled calculations and Greece's reported recycling rates according to the chosen method, 2015

Method 2	2015
Recycling rate calculated by the model (%)	26
Reported recycling rate (%)	26.5

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

Table 15 compares modelled calculations with Greece's reported amounts of waste generated and recycled in 2015.

Table 15 Comparison of modelled calculations and Greece's reported amounts of waste generated and recycled, 2015

Method 2	Generated	Recycled
Amounts calculated by the model ('000 tonnes)	2 325	604
Reported amounts ('000 tonnes)	2 325	616

6.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Greece moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

6.3.1 Environmental externalities and financial costs

Figure 37 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Greece the costs related to the full implementation scenario are higher than those for the baseline scenario, and that the net costs are driven by the financial costs.

As Greece moves from the baseline scenario towards full implementation, the difference in costs increases during the period 2015–2020, and then decreases significantly over the period 2020–2025. Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios diminishes after 2020, because in the baseline the recycling rate increases while it is stable in the full implementation scenario.

Figure 37 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

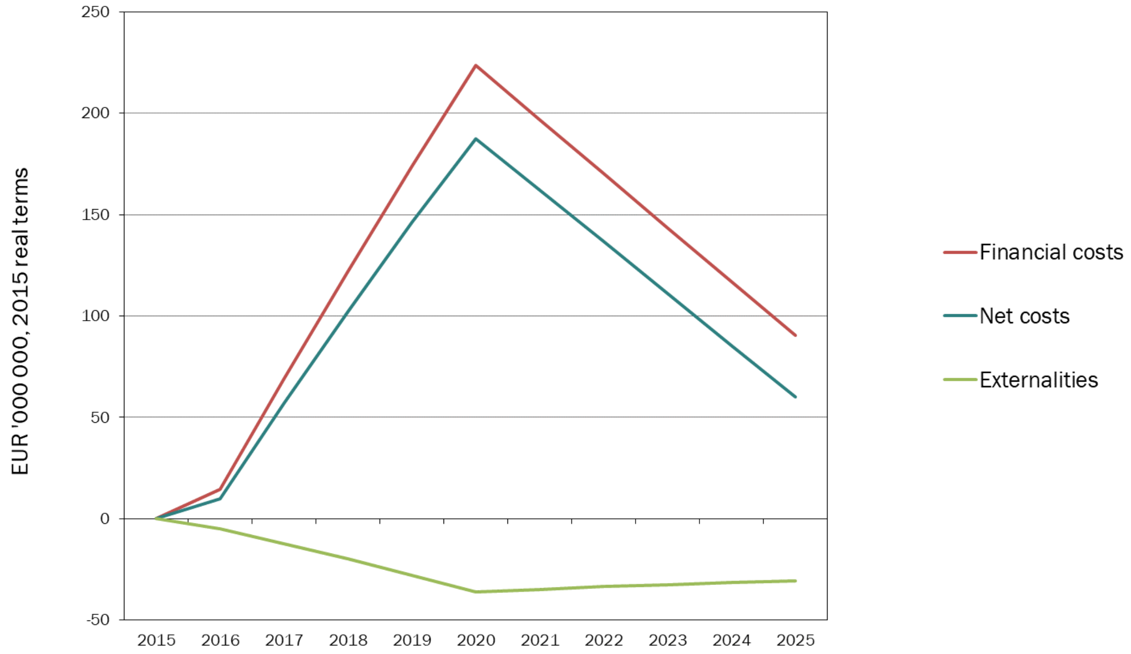
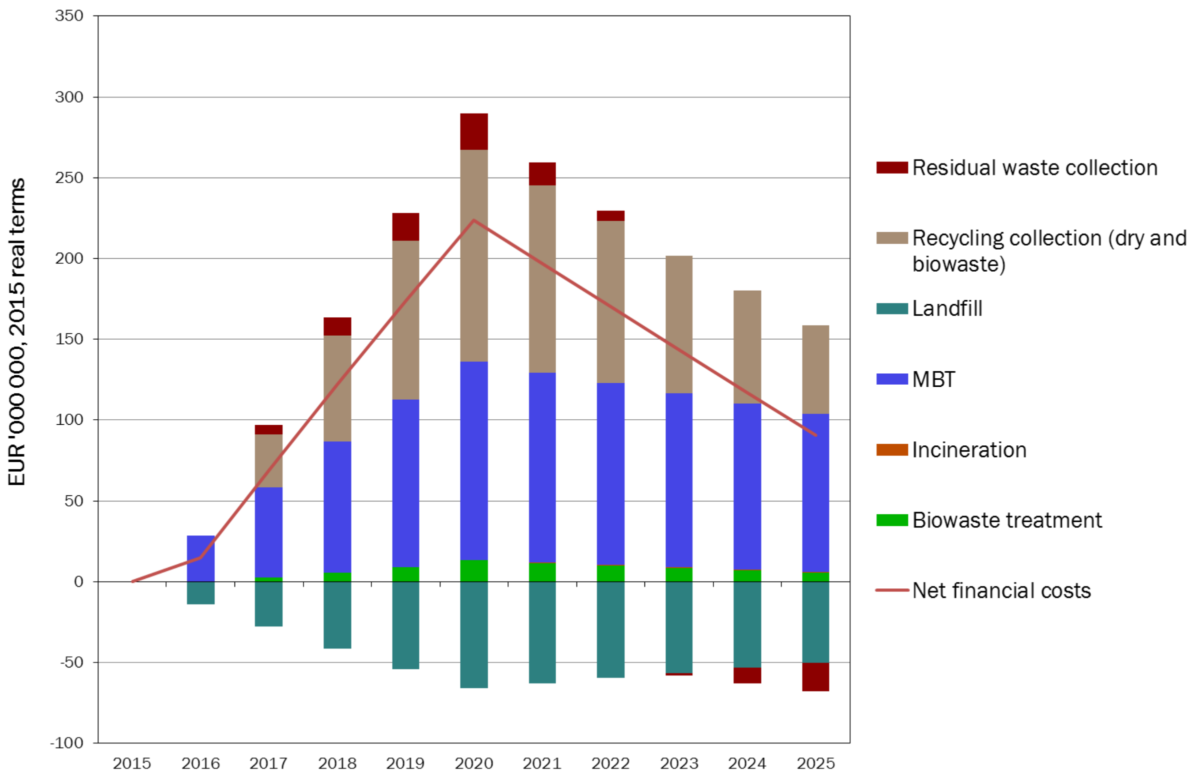


Figure shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 37.

To reach the EU WFD's 50 per cent recycling target, the model assumes that a certain amount of waste is diverted from landfill to recycling, as shown in Figure 36. However, MBT has the highest impact on the cost differential, in line with its increasing role under full implementation. As a result, the costs for MBT increase, together with those for recycling and residual waste collection. It seems counterintuitive that the cost for residual waste collection is higher in the full implementation scenario even though the amount of residual waste is lower. This is the result of moving to more complex and costly collection systems (Box 6), which also affect recycling costs.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the differences in costs between the two scenarios shrinks, as dry recycling and biowaste shares increase under the baseline, while they stay by definition constant under full implementation.

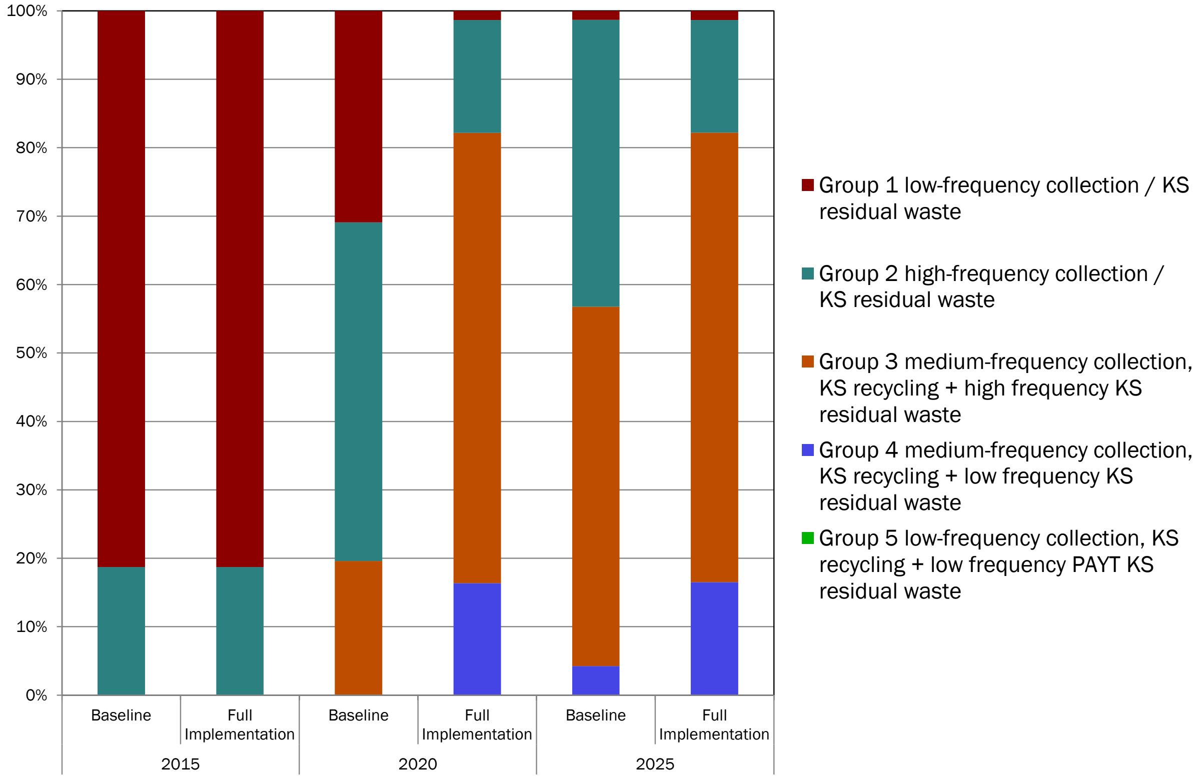
Figure 38 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 6 Greece's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (group 1), to advanced high-recycling ones (group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from system 1 to system 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of residual waste collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Greece, although the differences in recycling rates between the two scenarios are relatively small, the model assumes a change, by 2020, from a combination of Groups 1 and 2 collection systems to a combination of Groups 1, 2 and 3 under the baseline and Groups 2, 3 and 4 under full implementation. In 2025, Group 1 almost disappears, both in the baseline and under full implementation, but the latter scenario – which by definition implies constant shares after 2020 – implies a larger share of Group 4 as compared to the baseline.

Figure 39 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



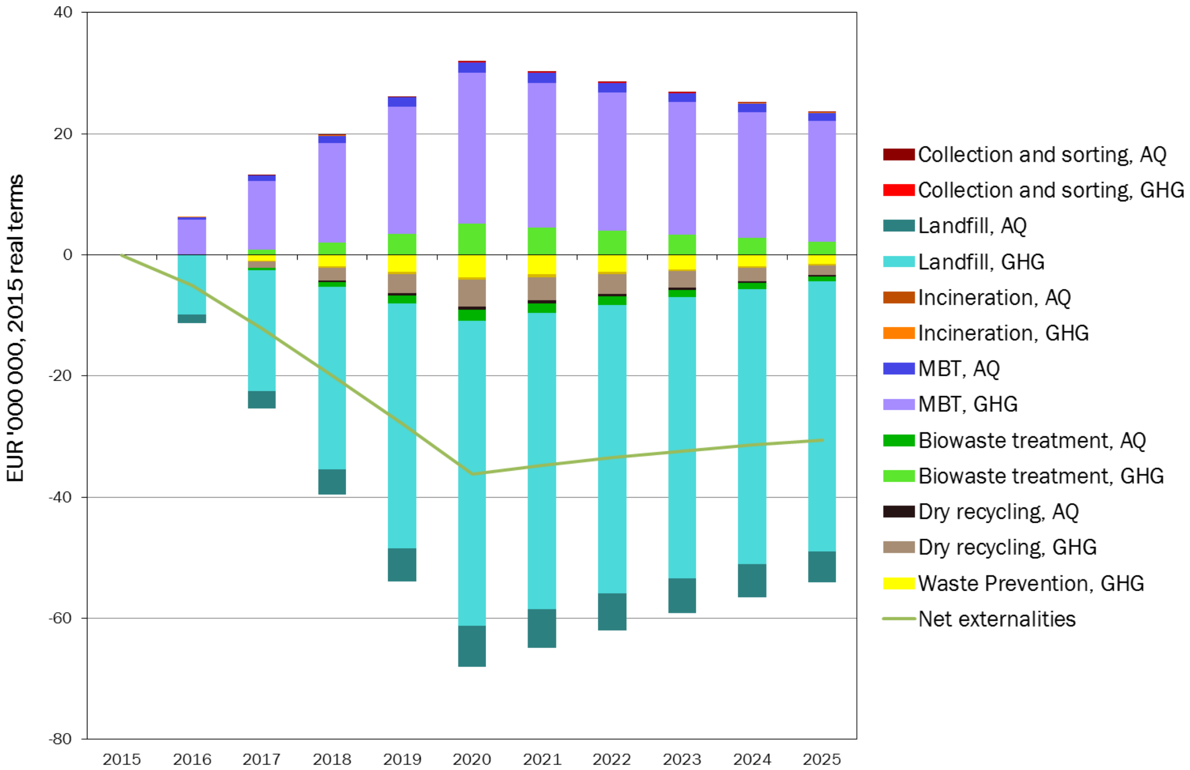
KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 40 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as those in Figure 37

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHGs and other air pollutant emissions from landfill as well as, to a smaller extent, more avoided emissions due to dry recycling[8] in the full implementation scenario. The small waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste leads to higher awareness among citizens. There are, however, additional external costs caused by higher GHG emissions from MBT and biowaste treatment under full implementation.

The graph shows the maximum avoided externalities related to full implementation in comparison with the baseline in 2020. In the period 2020–2025, the difference in avoided externalities decrease slightly, as the baseline scenario gets closer to full implementation.

Figure 40 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline scenario, 2015–2025



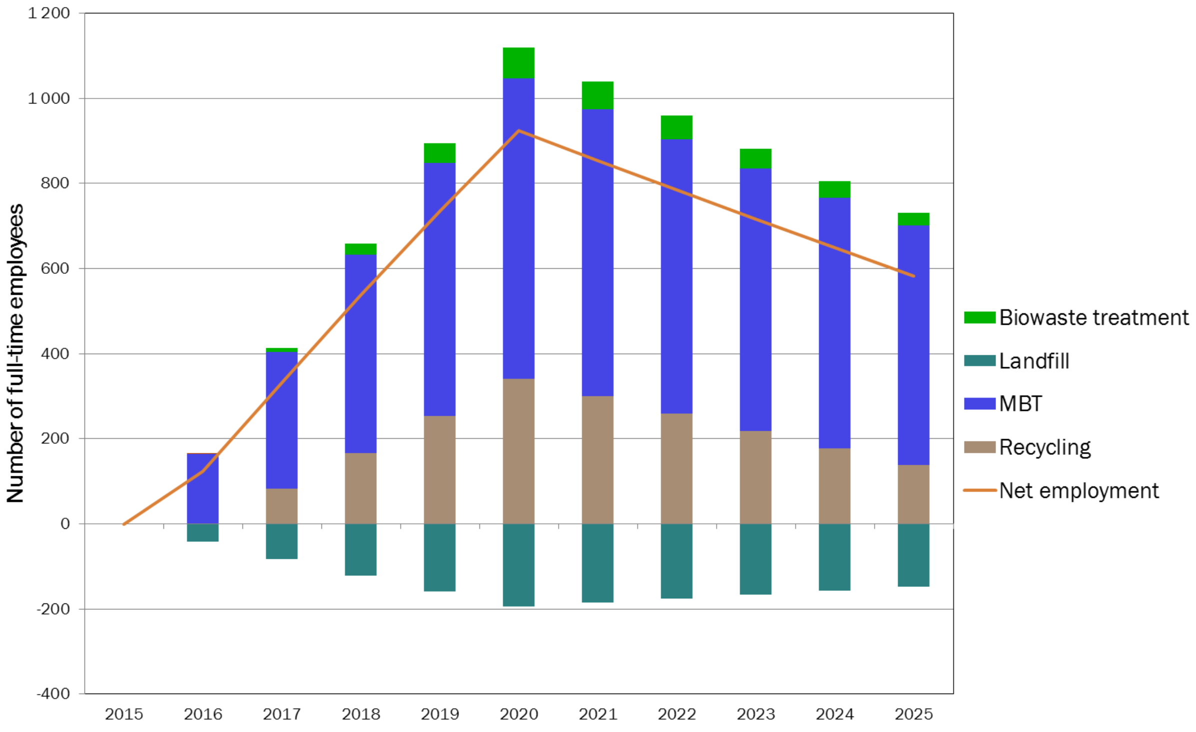
AQ: air quality
GHG: greenhouse gases

[8] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

6.3.2 Employment

Figure 41 shows a net creation of additional jobs under the full implementation scenario. Some jobs are lost at landfill sites but more are created in MBT plants, and, to a lesser extent, through recycling and biowaste treatment. The difference in employment between the two scenarios decreases after 2020, as in the case of costs.

Figure 41 Differences in the number of full-time employees in the full implementation scenario compared to the baseline, 2015–2025

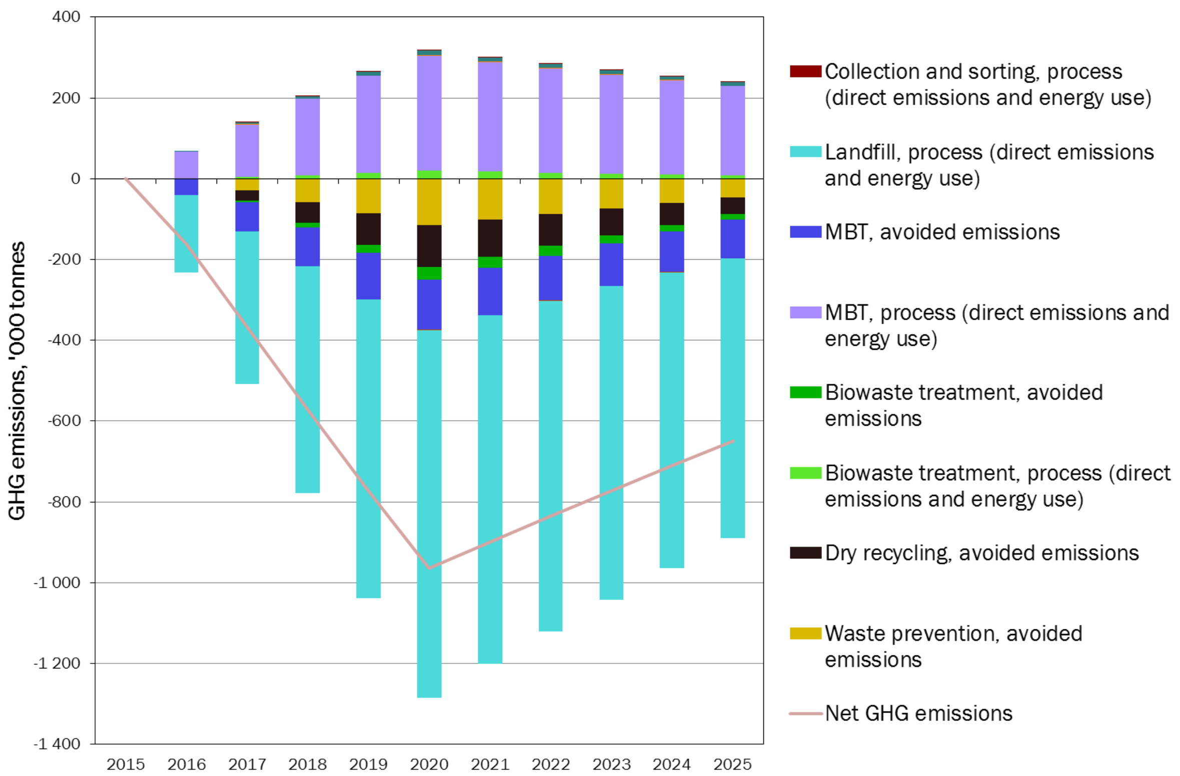


Note: Employment for residual waste collection is included in MBT, and employment for separate collection is included in recycling and biowaste treatment.

6.3.3 Greenhouse gas emissions

Figure 42 shows a significant net reduction in GHG emissions in the full implementation scenario compared to the baseline scenario. The largest amounts of avoided GHGs come from less MSW being sent to landfill, and to the related decrease in direct emissions and energy use. Process emissions from MBT, on the other hand, increase under full implementation. The net effect is, however, positive for the environment.

Figure 42 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

6.3.4 Conclusion

Greece is at risk of missing the 2020 WFD recycling target, illustrated by a modelled recycling rate of 42 per cent in 2020 in the baseline scenario, and 38 per cent following a customised modelling method that better reflects the planned measures regarding separate collection of biowaste and dry recyclables.

Moving from the baseline to full implementation would result in an increase in MBT and, to a lower extent, in the collection for dry recycling and biowaste treatment. The collection system would become more complex.

The full implementation scenario would bring reduced environmental externalities, but higher financial costs. Employment is expected to increase, mainly in MBT plants and in recycling.

7 Hungary

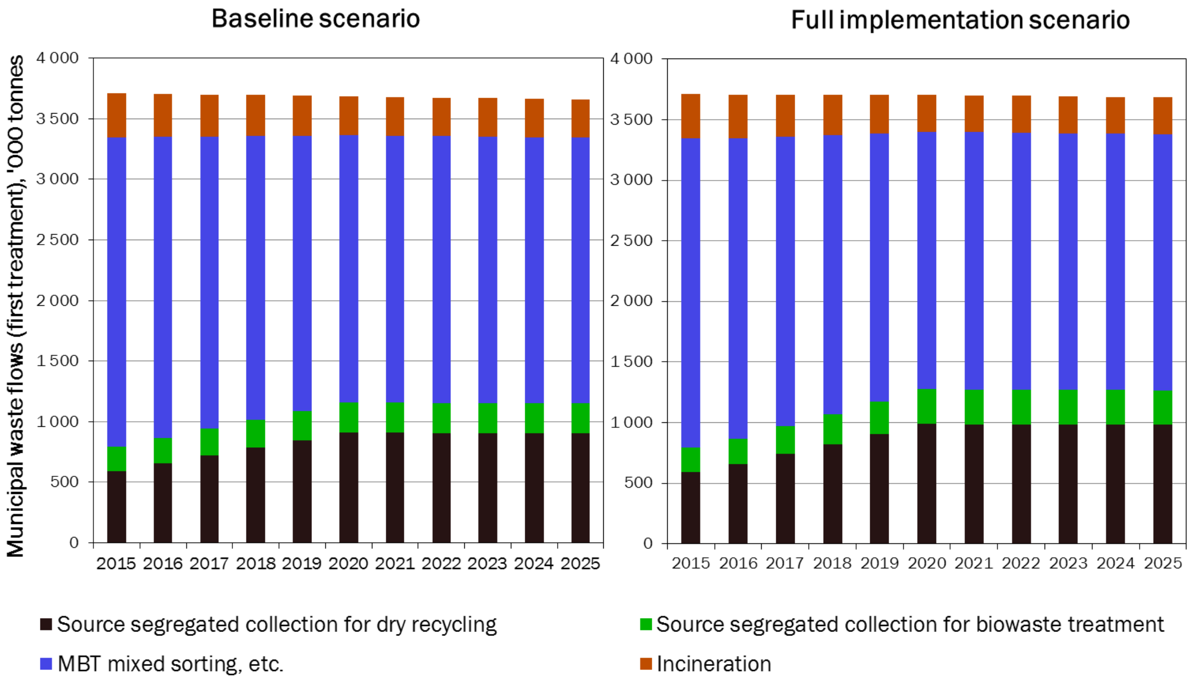
7.1 Development in the destinations of municipal solid waste

Figure 43 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

Total generation of MSW in Hungary is projected to be rather stable over the period 2015–2025.

The combination and shares in both scenarios are quite similar. However, driven by full implementation of the 2020 WFD target under the full implementation scenario, the speed of change and the amounts collected for dry recycling and biowaste treatment will be higher, though the difference between scenarios is relatively small. The reason behind this is that Hungary almost reaches the 50 per cent target in 2020 in the baseline scenario. In both scenarios, Hungary sends the majority of its MSW to MBT treatment.

Figure 43 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

7.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 16 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline model, under Method 2 Hungary will achieve a recycling rate of 46 per cent by 2020. As no policy measures are firmly planned after 2020, the baseline scenario does not assume further changes and the recycling rate stays constant until 2025. This is, of course, a pessimistic view, and Hungary might be expected to plan additional measures if it falls short of the 2020 target. However, these are not known and are thus not included in the baseline scenario.

Hungary has reported that it does not subtract rejects from reported recycling rates. Following this method, Hungary would achieve a 53 per cent recycling rate by 2020.

Table 16 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	35	37	39	42	44	46	46	46	46	46	46
Recycling rate without subtracting rejects (%)	40	43	45	48	51	53	53	53	53	53	53

Table 17 compares modelled calculations and reported data for 2015. The recycling rate reported by Hungary is higher than that calculated by the model. To explain the difference between the results, some additional calculations were done using the model. By default, the model calculates the recycling rate as the input to final recycling after subtracting the rejects (losses during sorting). However, Member States may report the amount of separately collected waste as recycled if there are no significant losses (European Commission Decision 2011/753/EU).

The recycling rate was therefore re-calculated without subtracting rejects. This method results in a recycling rate of 40 per cent, which is closer to the reported data.

Another reason for differences might lie in the way recyclables from MBT processes are calculated by Hungary compared to the model. Hungary sends a rather high share of generated MSW to MBT. The model calculates, based on data from different MBT plants in Europe and assumptions, how many recyclables are extracted during the MBT process. These extraction rates might differ from the amounts actually extracted for recycling in the Hungarian MBT plants.

Table 17 Comparison of modelled calculations and Hungary's reported recycling rates according to the chosen method, 2015

Method 2	2015
Recycling rate calculated by the model (%)	35
Recycling rate calculated by the model without subtracting rejects (%)	40
Reported recycling rate (%)	42

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

Table 18 compares absolute amounts of generated and recycled waste reported and calculated by the waste model. It seems that the recycled amount the model uses in its original form is (almost) the same as what the country reports, but there is a difference in the generated amounts of these waste fractions. In the waste model these generated amounts are calculated based on the waste composition, which in turn is estimated based on data for mixed (residual) MSW provided by Hungary and the reported amounts of separately collected wastes (more details can be found in Annex 2). It is not possible to explain the difference in generated amounts of waste with the information provided.

Table 18 Comparison of modelled calculations and Hungary's reported amounts of waste generated and recycled, 2015

Method 2	Generated	Recycled
Amounts calculated by the model ('000 tonnes)	1 622	561
Amounts calculated by the model including rejects ('000 tonnes)	1 622	641
Reported amounts ('000 tonnes)	1 331	560

If Hungary were to increase its recycling rate at the pace shown in Table 16, but starting from 42 per cent as reported for 2015, it would meet the 2020 target.

7.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Hungary moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

7.3.1 Environmental externalities and financial costs

Figure 44 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHG and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Hungary the costs related to the full implementation scenario are higher than those for the baseline, and that net costs are driven by financial costs.

As Hungary moves from the baseline towards full implementation, the difference in costs increases during 2015–2020 then remains constant between 2020 and 2025 because both scenarios assume no further changes in waste management.

Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios do not change after 2020.

Figure 44 Externalities, financial costs and net costs of the full implementation

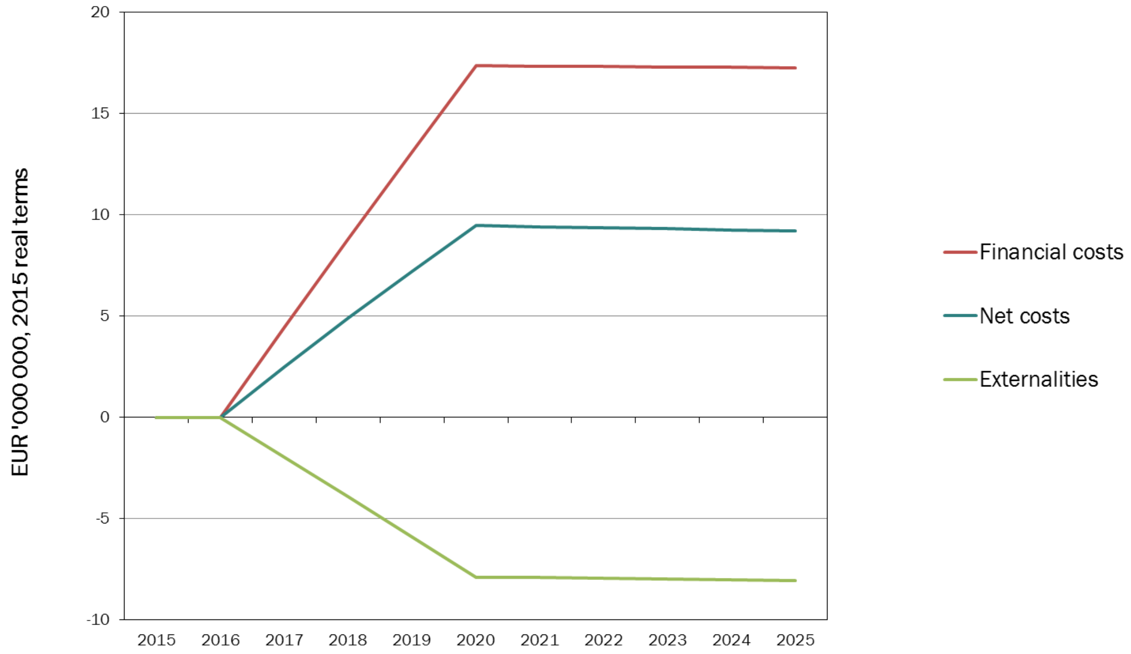
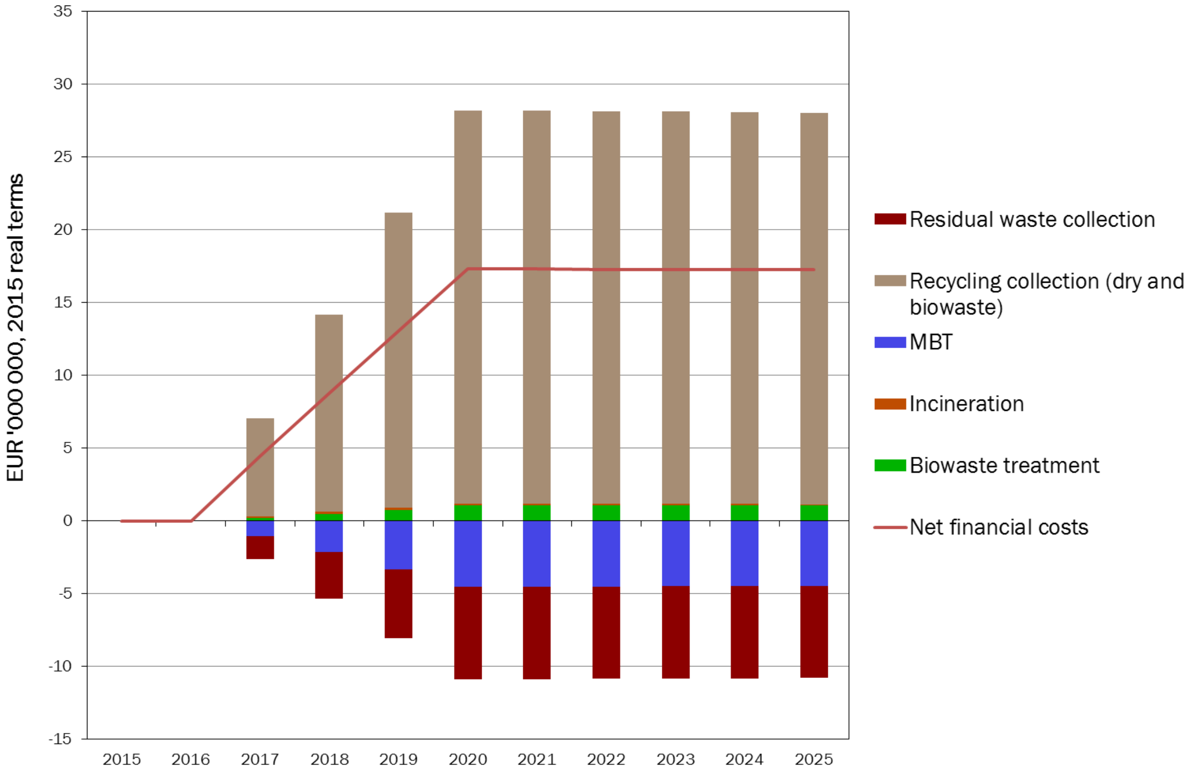


Figure 45 shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 44.

To reach the WFD's recycling target, the model assumes that a certain amount of waste is diverted from MBT and incineration to recycling. This results in lower costs for MBT and higer costs related to source-segretated collection for dry recycling and biowaste treatment in the full implementation scenario. The costs related to residual waste collection go down. Costs for collection also change when moving to the full implementation scenario because the model assumes that higher recycling rates require the use of more sophisticated collection systems with higher overall costs (Box 7). Although less waste is going directly to incineration, there is a small increase in related costs because the rejects of recycling are being incinerated.

The difference in costs does not change after 2020 because the two scenarios remain stable (Figure 45).

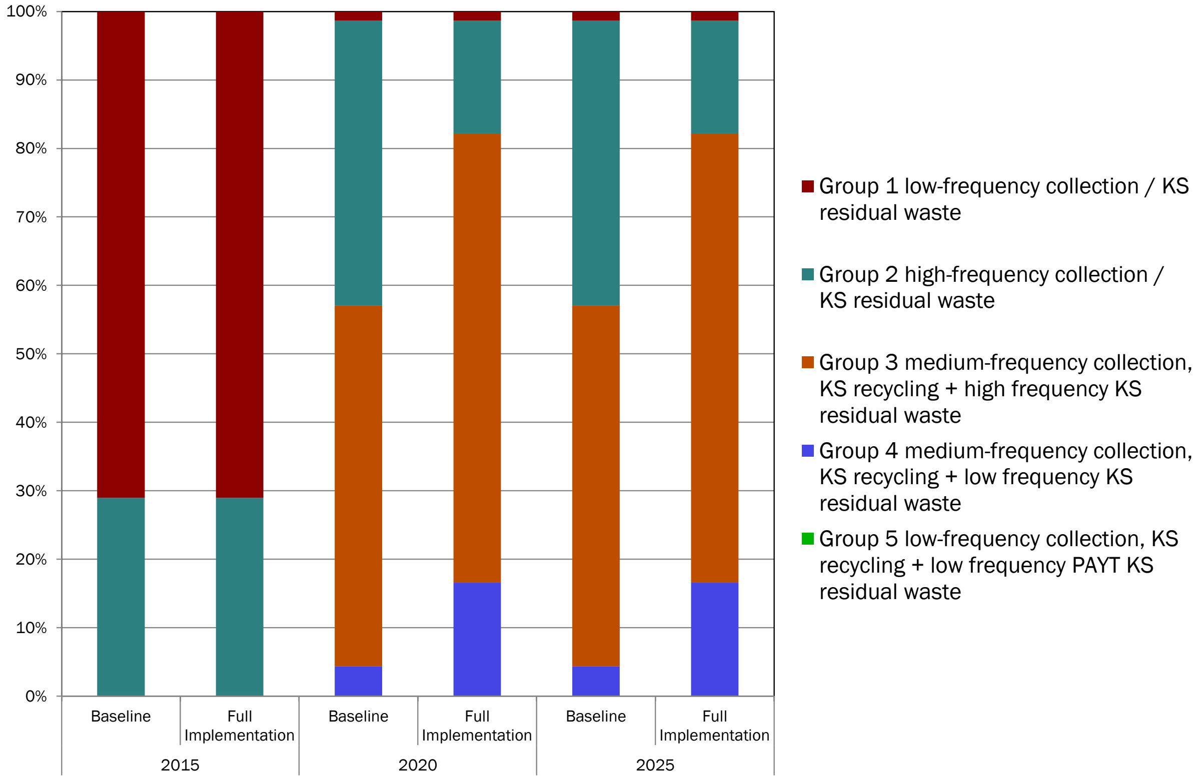
Figure 45 Financial costs of waste collection and treatment in the full implementation



Box 7 Hungary's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of refuse (residual waste), except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Hungary, although the differences in recycling rates between the two scenarios are relatively small, the model assumes a change from a combination of Groups 1 and 2 collection systems to a combination of Groups 1, 2, 3 and 4 for both scenarios. When moving from the baseline to full implementation the shares of the more advanced Groups 3 and 4 increase.

Figure 46 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



KS: kerbside collection

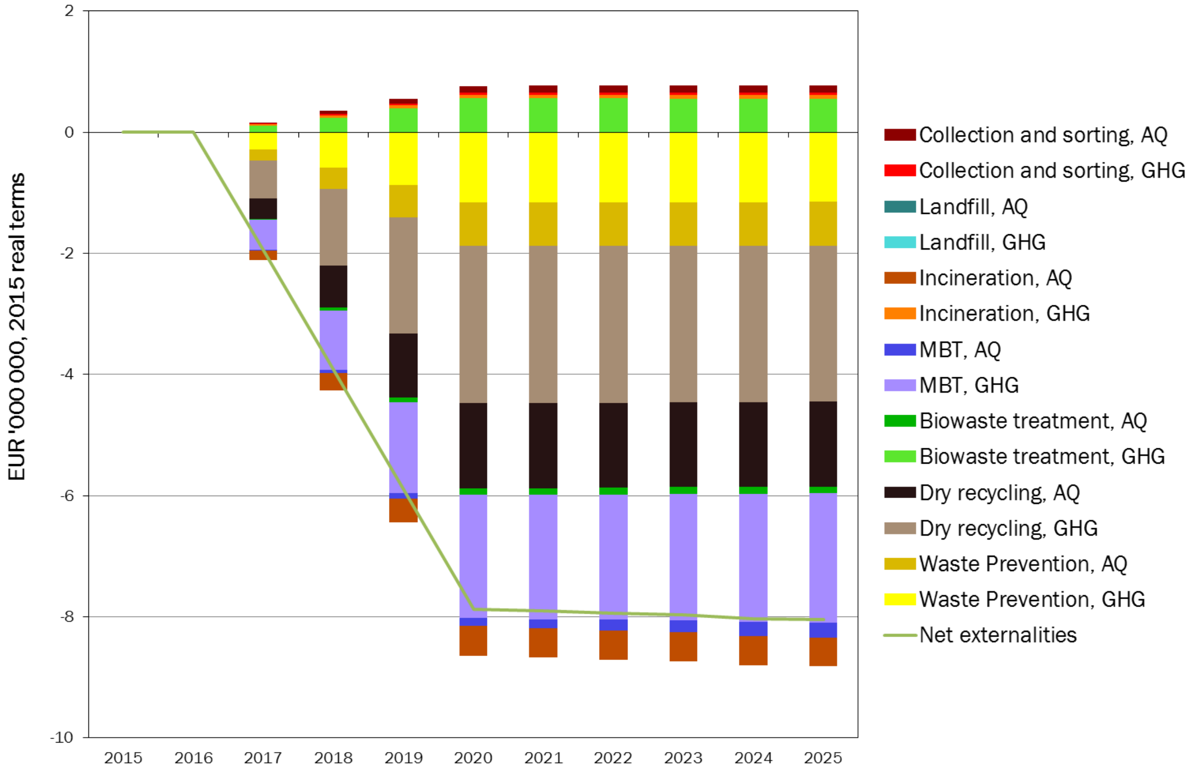
PAYT: pay as you throw

Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 47 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as those in Figure 44.

Figure 47 shows an increasing avoidance of externalities related to full implementation in comparison with the baseline up to 2020, with the difference stabilising towards 2025. The significant difference is mainly due to the combined effect of avoided GHGs and other air pollutant emissions related to dry recycling[9] and MBT in 2015–2020. The waste prevention effect is a result of the assumption in the model that the introduction of separate collection of food waste leads to higher awareness of food waste among citizens, resulting in a small prevention effect. In the period 2020–2025, the difference in avoided externalities barely changes.

Figure 47 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



7.3.2 Employment

Figure 48 shows a net creation of additional employment under the full implementation scenario. While some jobs are lost at MBT plants, more are created through collection and processing of recyclables and biowaste. The difference in employment between the two scenarios does not change after 2020.

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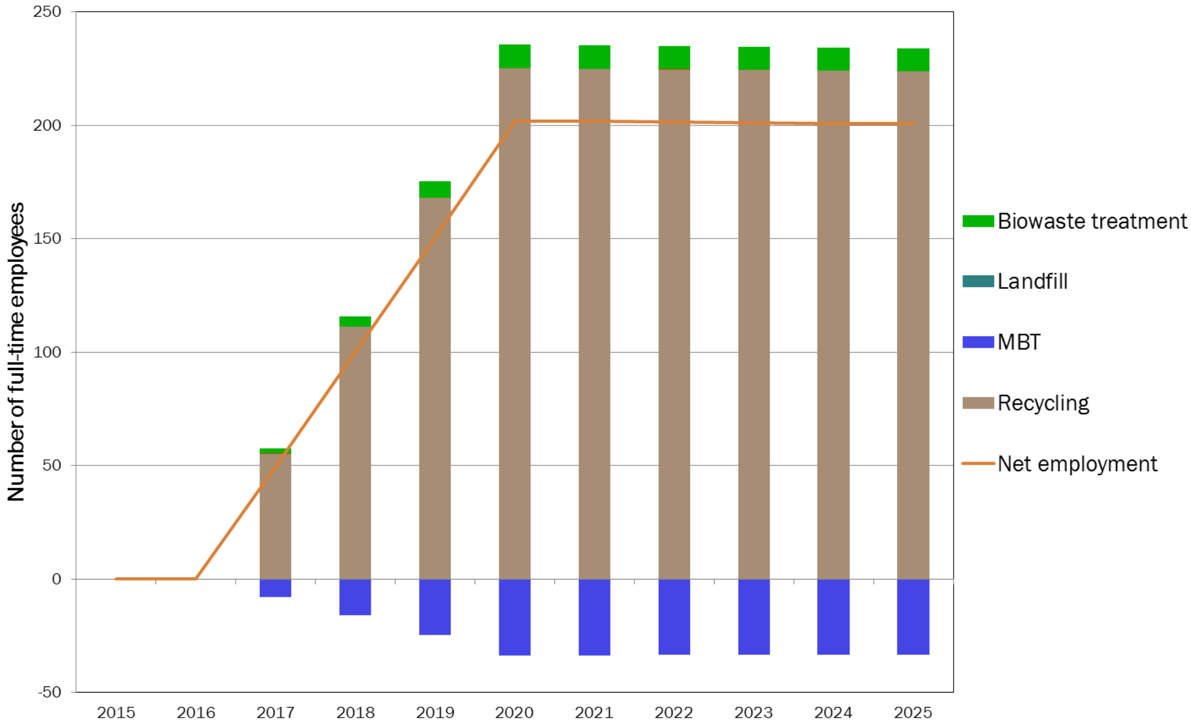
9 More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 48 Differences in the number of full-time employees in the full implementation

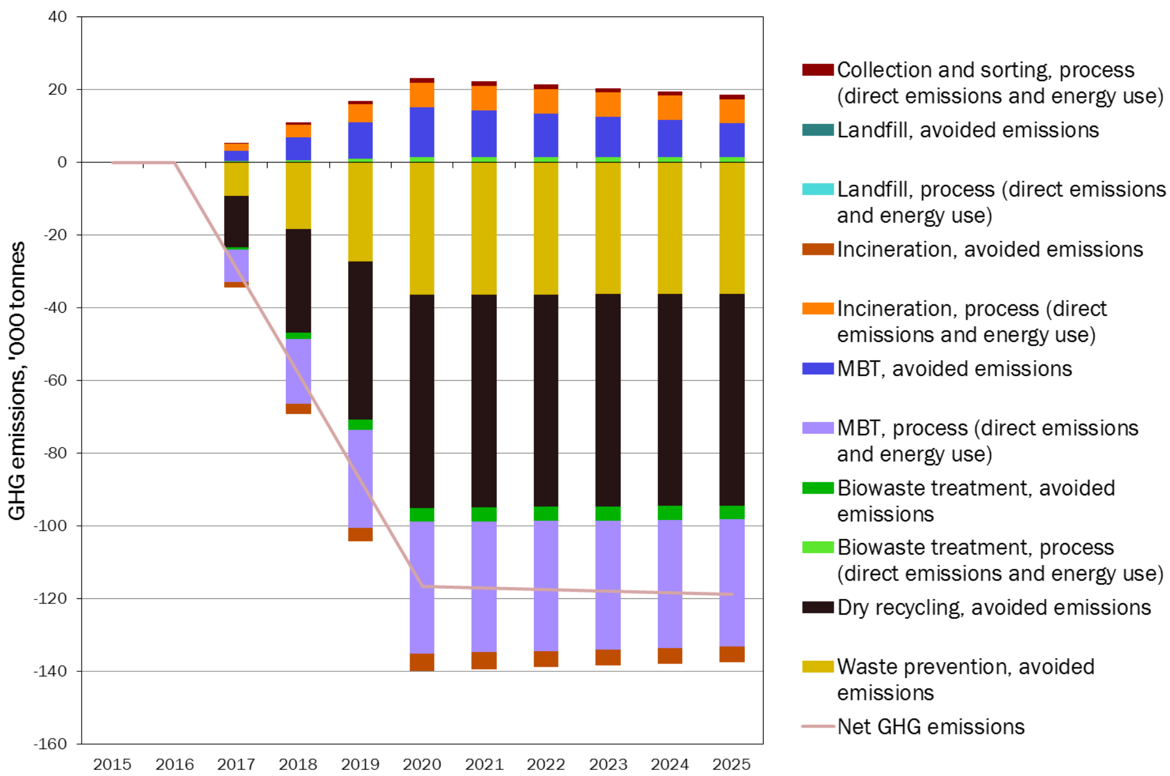


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

7.3.3 Greenhouse gas emissions

Figure 49 shows a significant decrease in net GHG emissions in the full implementation scenario. The largest amounts of avoided GHGs result from more waste going to recycling. As less waste is being treated in MBT in the full implementation scenario, the corresponding avoided emissions are lower than in the baseline (showing a net impact). Again, the effect of food waste prevention is visible. After 2020, avoided emissions from MBT change slightly, driven by a change in the projected energy mix in Hungary.

Figure 49 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

7.3.4 Conclusion

Hungary is at risk of missing the WFD 2020 recycling target, illustrated by a modelled recycling rate of 46 per cent in 2020. However, if Hungary would increase its recycling rate at the same pace as shown in Table 16, but starting from 42 per cent as reported in 2015, the country would meet the target by 2020. When moving from the baseline to full implementation the recycling rate increases while the amounts going directly to MBT decrease.

The full implementation scenario would bring increased costs related to the collection for recycling. It would also bring higher employment mainly in recycling. Externalities are reduced when moving from the baseline to full implementation.

8 Latvia

8.1 Development in the destinations of municipal solid waste

Figure 50 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

Latvia provided a waste generation projection up to 2020 and the ETC/WMGE extended this until 2025. The projection assumes that generated amounts of MSW will decrease, particularly in the period to 2020, and slightly further thereafter.

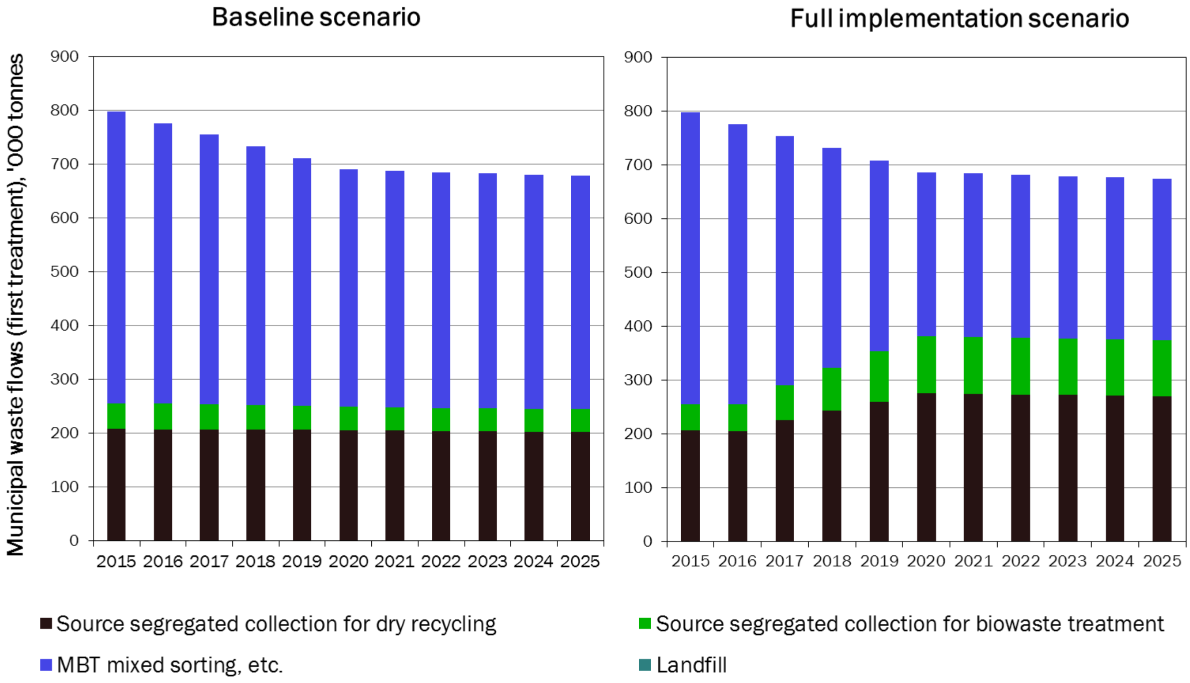
Under the baseline scenario, the share of waste separately collected for dry recycling increases slightly, though due to the decreasing amounts of generated waste the absolute amount is almost constant. The absolute amount collected for biowaste treatment decreases a little under the baseline scenario, but the share of waste collected for biowaste treatment remains the same. The amount of residual waste sent to MBT diminishes under the baseline scenario as a result of diminishing waste generation and the increasing share of separate collection. Under the baseline scenario Latvia would not reach the 50 per cent recycling target of the WFD, as the effects of the planned policy measures to increase recycling are considered to be rather uncertain.

Latvia is currently sending no waste directly to landfill or incineration, and this is assumed to remain the case under both scenarios.

For the full implementation scenario, in order to reach the 50 per cent recycling target of the WFD, the amounts of waste collected for recycling and biowaste treatment increase at the expense of residual waste sent to MBT.

No further changes happen in either scenario after 2020. The full implementation scenario is kept constant because the targets are reached in 2020, and the baseline scenario is kept constant because there are no indications of policy measures or new capacity taking effect after 2020.

Figure 50 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

8.2 *Distance to the 50 per cent recycling target of the Waste Framework Directive*

Table 19 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 4 Latvia will achieve a recycling rate of 33 per cent by 2020 with no further increase to 2025. This is of course a pessimistic view, and Latvia might be expected to plan additional measures if it falls short of the target in 2020. However, these are not known and are thus not included in the baseline scenario.

Table 19 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	30	31	31	32	33	33	33	33	33	33	33

Table 20 compares modelled calculations and reported data. The 2015 recycling rate calculated by the model is higher than the recycling rate reported by Latvia. A possible reason for this might be that Latvia reports all residual waste as directed to MBT, but the MBT treatment and efficiencies in extracting of recyclables from MBT plants in Latvia might differ from those used in the model. Another reason might be differences in applied rejects rates: by default, the model subtracts losses occurring during sorting of separately collected waste based on standard reject (loss) rates, but Latvia might experience higher loss rates than those used in the model.

Table 20 Comparison of modelled calculations and Latvia's reported recycling rates according to the chosen method, 2015

Method 4	2015
Recycling rate calculated by the model (%)	30
Reported recycling rate (%)	27

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

8.3 Impacts related to municipal solid waste management

All the following graphs show the changes in impacts that would occur if Latvia moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

8.3.1 Environmental externalities and financial costs

Figure 51 gives an overview of the changes in costs when moving from the baseline to full implementation. This overview is given for financial costs, externalities (monetised environmental costs of emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Latvia the costs related to the full implementation scenario are lower than those related to the baseline scenario, and that the net costs are driven by the financial costs. Externalities in the full implementation scenario are also lower, enabling environmental benefits to be realised when moving to full implementation. In both scenarios, the treatment shares do not change after 2020, and the small changes after 2020 are only due to the decrease in generated waste.

Figure 51 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

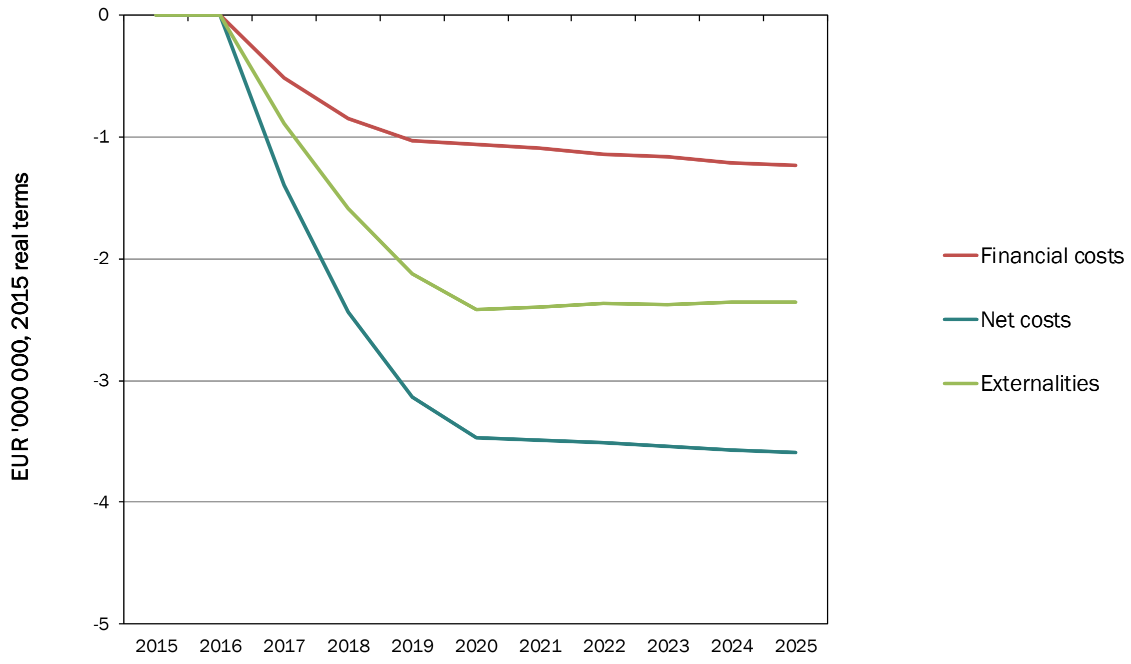


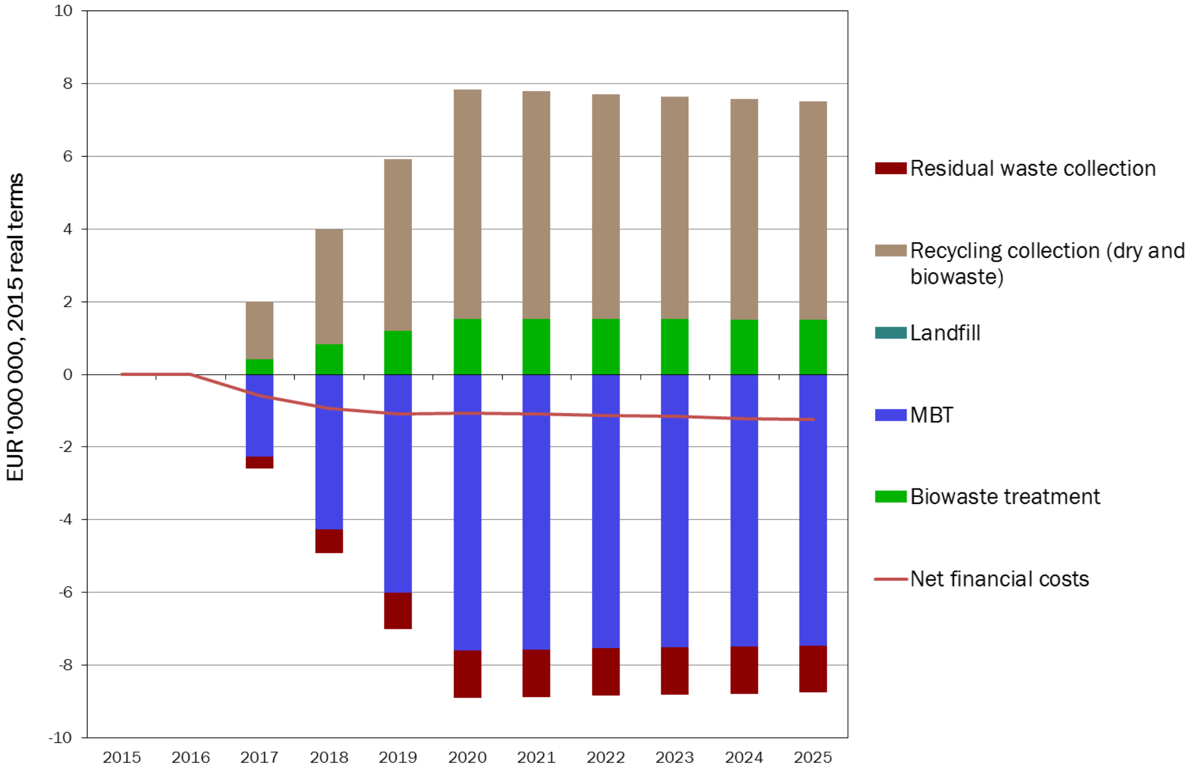
Figure 52 shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 51.

The increased collection for recycling when moving from the baseline scenario to full implementation results in higher costs for collection for recycling and lower costs for residual waste collection. Increased biowaste treatment in the full implementation scenario also results in higher costs (see also Box 8).

The baseline scenario indicates higher amounts of waste being sent to MBT than the full implementation scenario, explaining why there are cost savings related to MBT treatment in the full implementation scenario. In reality, however, these cost savings might not be realised because the existing MBT capacity still generates costs even if not fully used, unless its capacity can be filled with imported waste or waste other than MSW.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the difference stagnates as both the baseline and full implementation scenario remain stable.

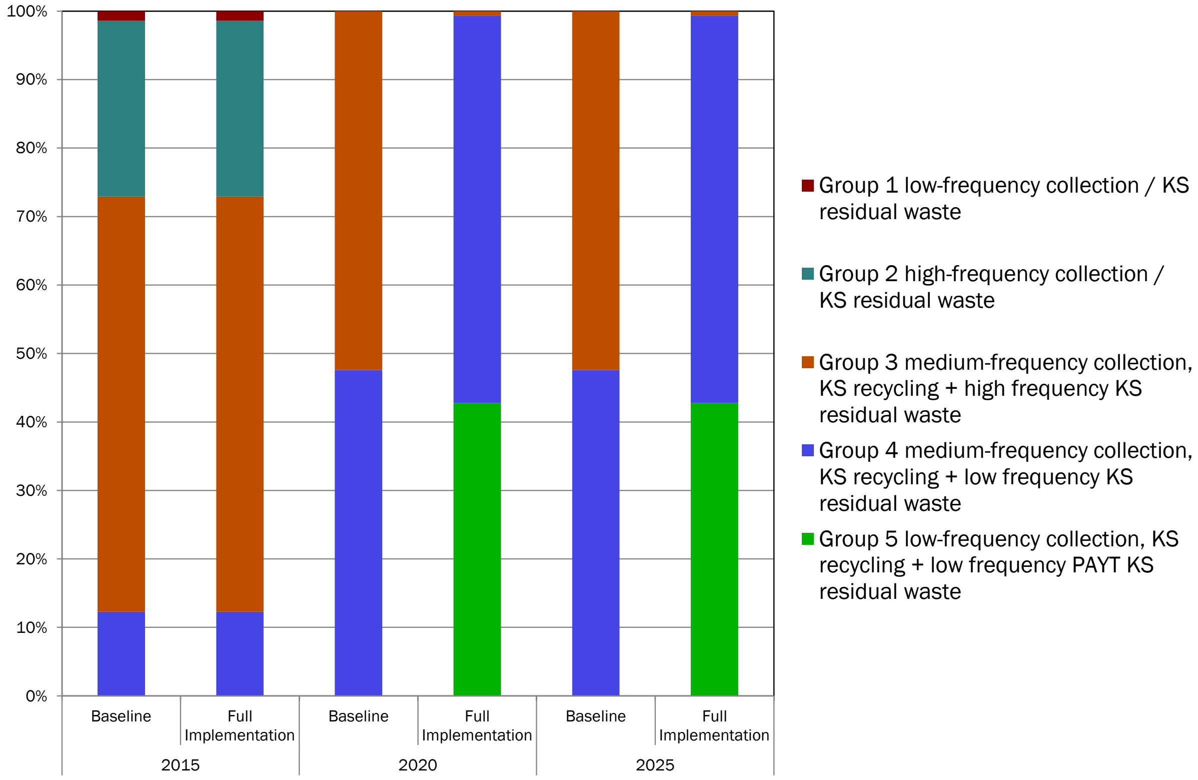
Figure 52 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 8 Latvia's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of refuse (residual waste), except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Latvia, the model assumes a change from a combination of Groups 2, 3 and 4 with a minor level of Group 1, to a combination of Groups 4 and 5 when moving from the baseline to the full implementation scenario. There is no further change beyond 2020 as both scenarios for Latvia remain the same after 2020.

Figure 53 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households

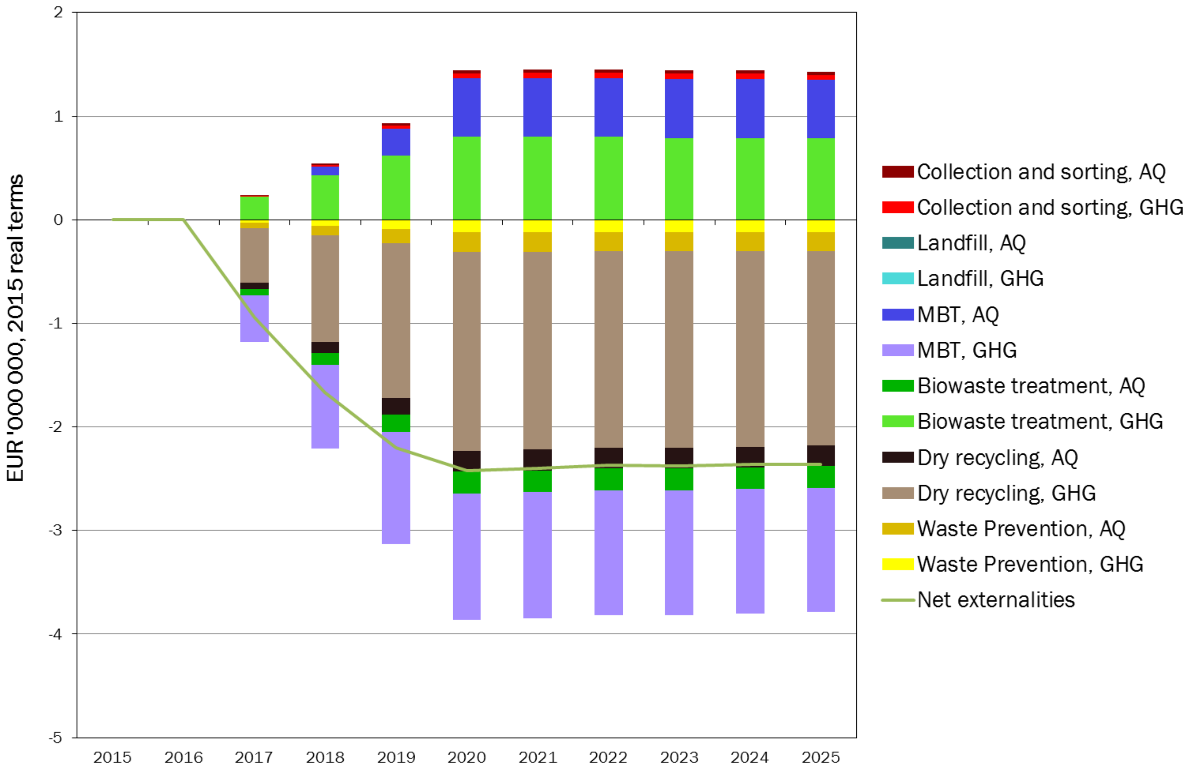


KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 54 shows externalities related to the collection and treatment of MSW when moving from the baseline to the full implementation scenario. The externalities indicated in this graph (green line) are those in Figure 51.

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This is mainly driven by reduced GHG emissions from recycling in the full implementation scenario[10] and to a lesser extent from MBT. There are, however, externalities caused by higher GHG emissions from biowaste treatment and externalities related to emissions of other air pollutants from MBT in the full implementation scenario. The latter seems to be counterintuitive, but might be explained by the assumption in the model that waste recovered as fuel during the MBT process replaces dirtier energy from other sources. The small waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste leads to higher awareness of food waste among citizens, resulting in a small prevention effect.

Figure 54 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline scenario, 2015–2025

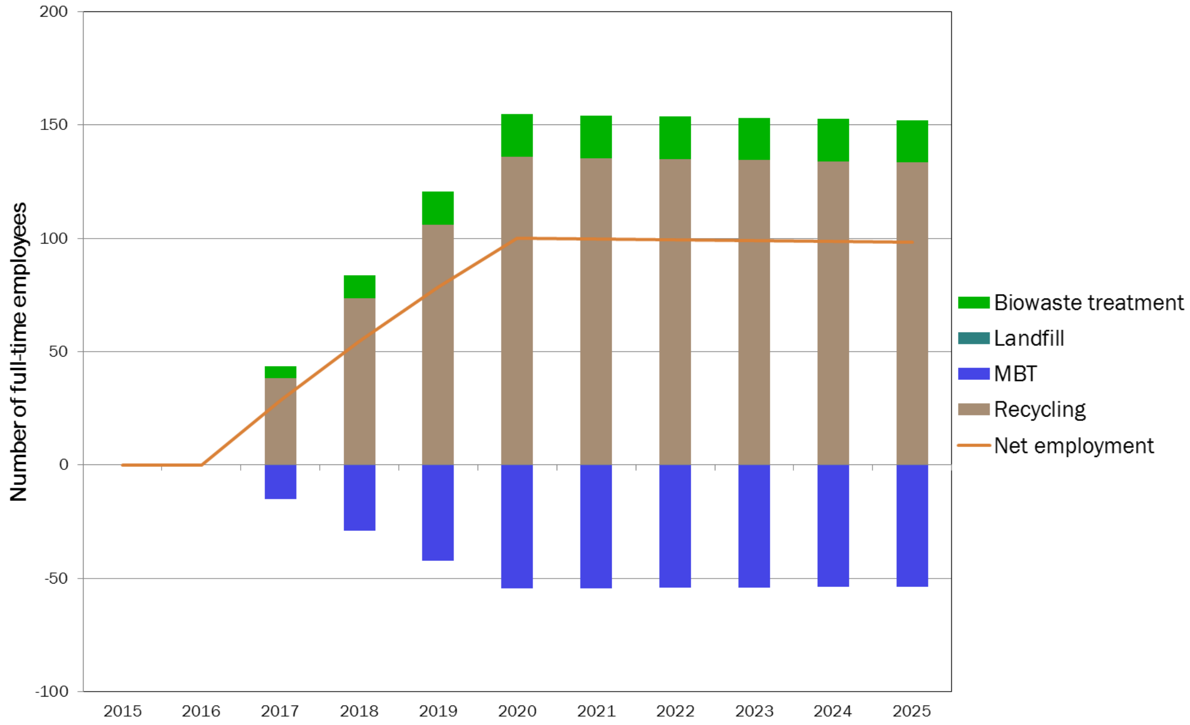


8.3.2 Employment

Figure 55 shows a net creation of additional employment under the full implementation scenario. While some jobs are lost at MBT facilities, more are created through the increase in dry recycling and biowaste treatment.

[10] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 55 Differences in the number of full-time employees in the full implementation

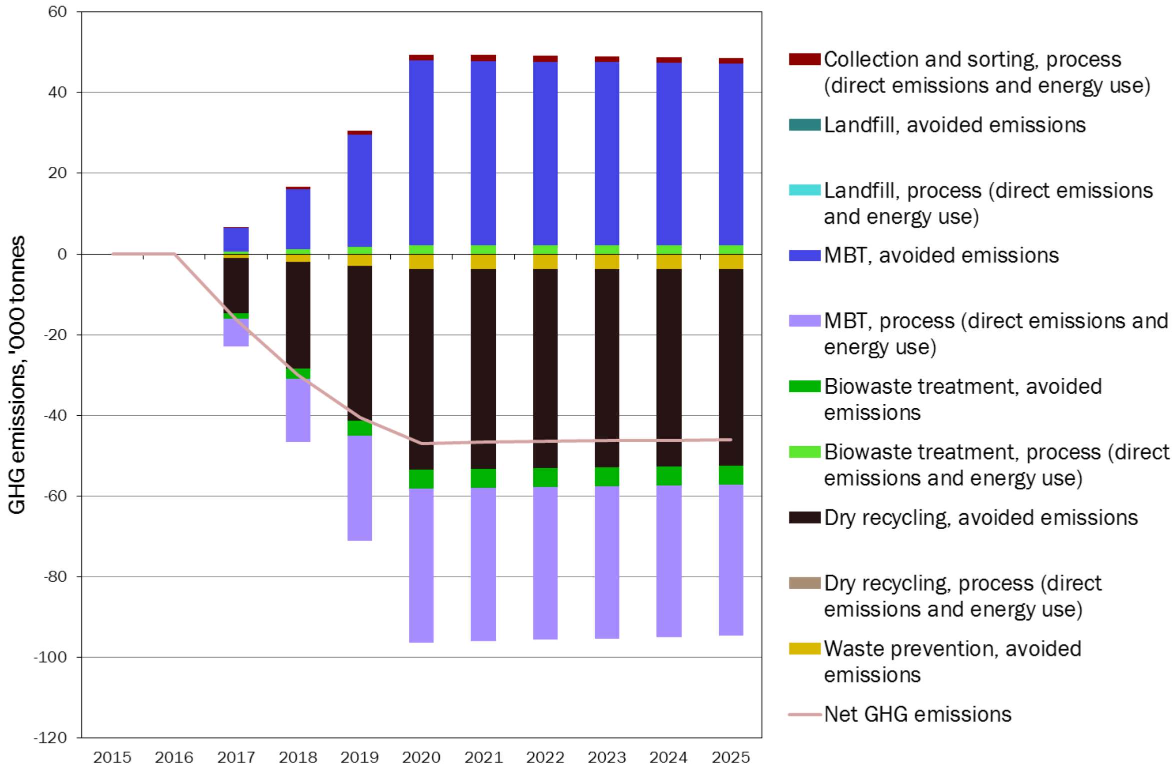


Note: Employment for residual waste collection is included in MBT, and employment for separate collection is included in recycling and biowaste treatment.

8.3.3 Greenhouse gas emissions

Figure 56 shows a significant decrease in GHG emissions in the full implementation scenario. The largest amounts of avoided GHGs result from an increase in dry recycling and a decrease in MBT treatment. Emissions from biowaste treatment are also lower. MBT generates direct GHG emissions from the process, but also generates refuse-derived fuel that replaces energy from other sources and thus avoids GHG emissions. Less MBT in the full implementation scenario thus results in both fewer direct emissions and fewer avoided emissions.

Figure 56 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

8.3.4 Conclusion

Latvia is at risk of missing the 2020 WFD recycling target, illustrated by a modelled recycling rate of 35 per cent in 2020 in the baseline scenario, which might also be quite an optimistic calculation as Latvia reported a lower recycling rate than the one calculated by the model for 2015.

In order to achieve the recycling target by 2020 under Method 4, Latvia will have to increase recycling and send less MSW to MBT.

The full implementation scenario would reduce environmental externalities and financial costs while increasing employment, mainly in recycling.

9 Malta

9.1 Development in the destinations of municipal solid waste

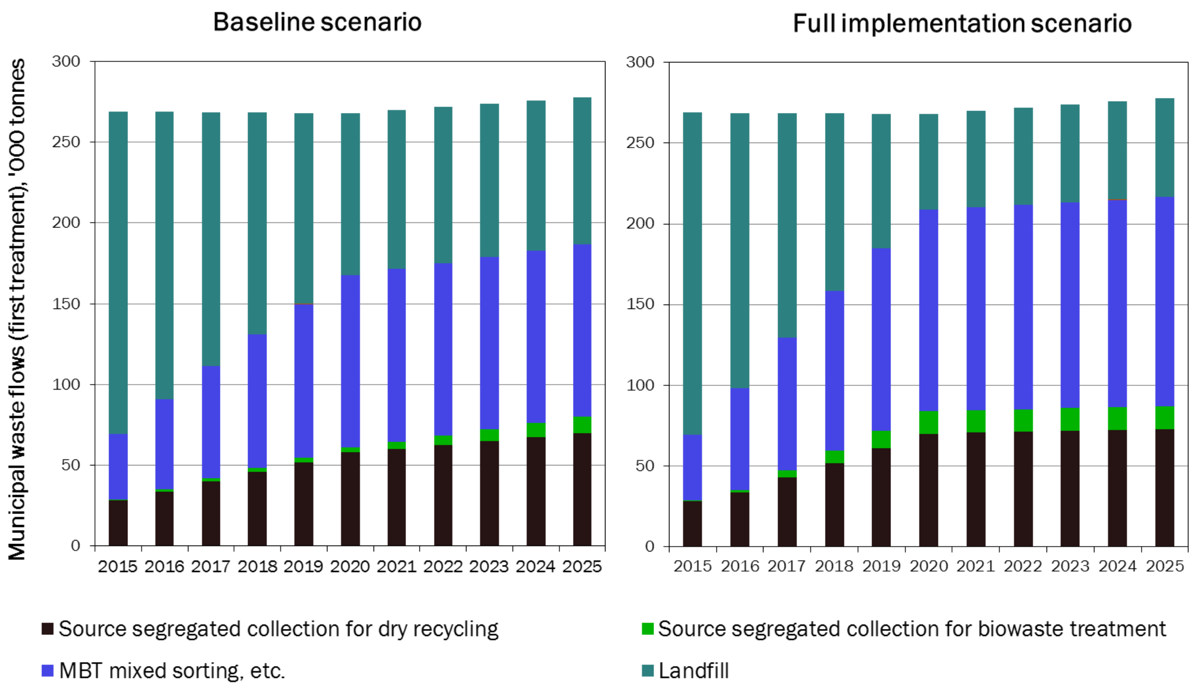
Figure 57 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

Generated amounts of MSW are projected to stay rather stable in the period 2015–2025, with a small increase towards 2025 (Figure 57). Under both scenarios the amount of waste Malta sends to landfill will decrease, and the amount sent for MBT increase. Driven by full implementation of the Landfill Directive's diversion targets for biodegradable municipal waste, however, under the full implementation scenario both the speed of change and the amounts sent to MBT will be greater.

The share of MSW separately collected for dry recycling and biowaste treatment will hardly increase when moving to the full implementation scenario. The reasons for this include that Malta uses Method 1, which only includes paper/card, glass, plastics and metals; in the baseline scenario Malta achieves 41 per cent recycling according to Method 1 by 2020; and Method 1 only refers to household waste, rather than all MSW.

After 2020, waste separately collected for dry recycling and biowaste treatment continues to increase slightly while no further developments take place in the full implementation scenario, therefore the differences between the two scenarios decrease slightly.

Figure 57 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

9.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 21 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline modelling, under Method 1 Malta will achieve a recycling rate of 41 per cent by 2020 and 47 per cent by 2025, and thus is at risk of missing the recycling target.

Table 21 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 1	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	20	24	28	33	37	41	42	43	45	46	47
Recycling rate (%), customised	20	24	26	28	29	31	32	33	34	35	36

Table 22 compares modelled calculations and reported data. The recycling rate reported by Malta is lower than that calculated by the model. This might be caused by the fact that Malta experiences higher reject rates than the standard reject rates applied in the model. Another reason might be that Malta sends quite a high share of waste to MBT. The model assumes by default that some fractions are recovered for recycling during the process. It might be that Malta experiences lower recovery rates than those calculated by the model. A third reason for the difference might be because the ETC/EEA made some adjustments to the recycled amounts because the data provided in the questionnaire were not fully consistent. More details can be found in Annex 2 of this report. The available information about the reported recycling rate does not allow further analysis of the observed differences between the modelled and reported recycling rates.
To calculate future recycling rates, the model uses average material capture rates in combination with actual country specific capture rates per material group. If a country plans to implement a collection system for materials for which there is currently no separate collection, or if this new system will influence the balance between bio and dry collection the future recycling rates calculate by the model will not reflect the actual plans of the country. To better reflect the actual plans of Malta regarding the introduction of separate collection for biowaste, a customised calculation was done which takes into account these efforts. The results of these customised calculations are shown in Table 21 in the bottom row.
In addition, with the recycling rate reported by Malta for the year 2015 and the same percentage point increase in recycling up to 2020 as modelled, the risk of Malta missing the WFD 50 per cent recycling target increases.

Table 22 Comparison of modelled calculations and Malta's reported recycling rates according to the chosen method, 2015

Method 1	2015
Recycling rate calculated by the model (%)	20
Reported recycling rate (%)	16

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

9.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Malta moves from the baseline to the full implementation scenario in 2015–2025 (full implementation scenario minus baseline scenario).

9.3.1 Environmental externalities and financial costs

Figure 58 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGS and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Malta the costs related to full implementation are higher than those related to the baseline, and that the net costs are driven by the financial costs.

As Malta moves from the baseline scenario towards the full implementation scenario, the difference in costs increases up to 2020. But as the baseline scenario moves closer to the full implementation scenario between 2020 and 2025, the difference in costs decreases.

Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios diminishes after 2020, because in the baseline the recycling rate increases while it is stable in the full implementation scenario.

Figure 58 Externalities, financial costs and net costs of the full implementation

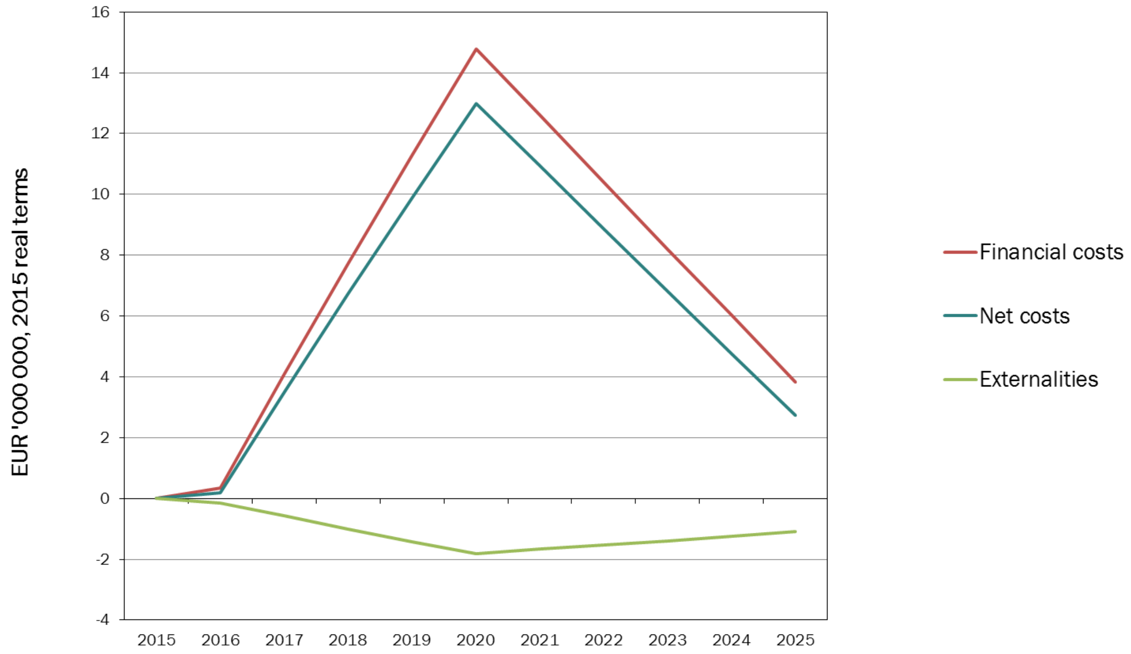
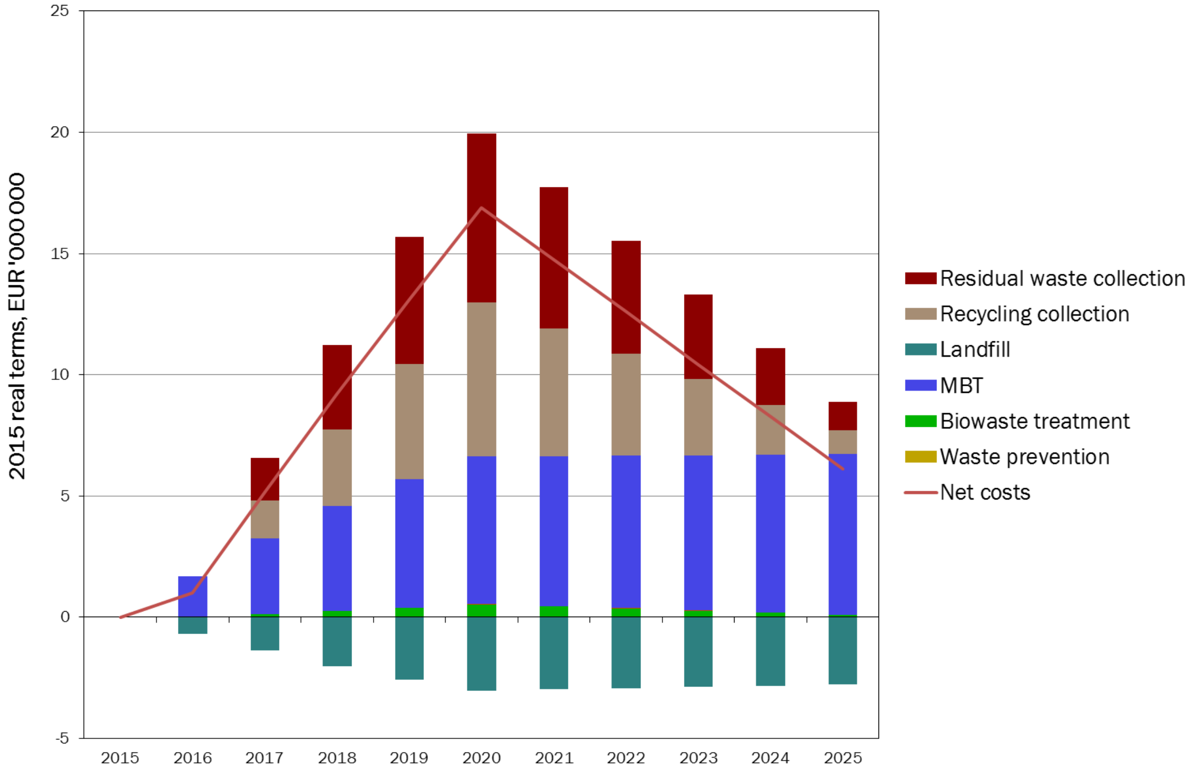


Figure 59 shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 58.

To reach the EU Landfill Directive's landfill diversion target, the model assumes that a certain amount of waste is diverted from landfill to MBT. This results in higher MBT costs and lower landfill costs in the full implementation scenario; there are also higher costs related to waste collection – both residual waste and for recycling. Costs for collection of residual waste are higher in the full implementation scenario despite lower amounts of residual waste. The reason is that the model assumes a change in collection systems, with increasing frequency of collection (Box 9).

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 the additional costs for collection diminish as the baseline collection rates for recycling move nearer the full implementation ones. The differences in treatment costs (MBT) stay the same after 2020 as more waste continues to be diverted from landfill in the full implementation scenario than the baseline (Figure 59).

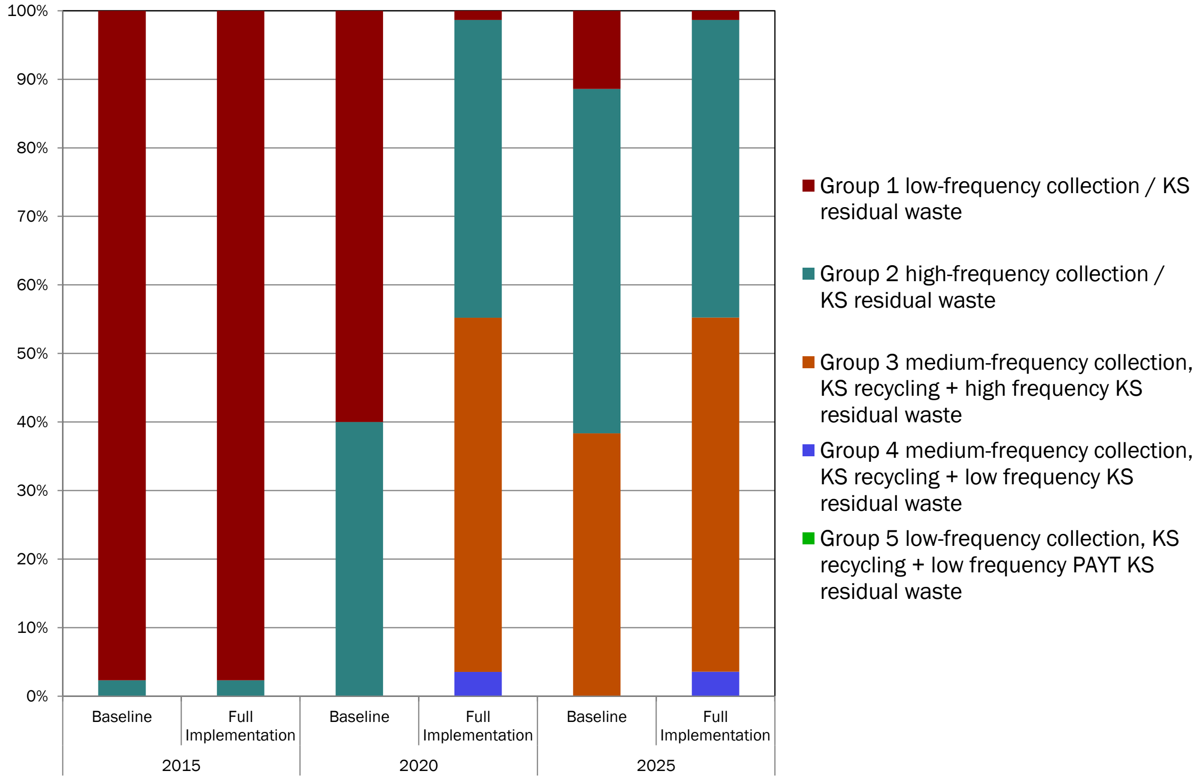
Figure 59 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 9 Malta's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of refuse (residual waste), except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Malta, although the differences in recycling rates between the two scenarios are relatively small, the model assumes a change from a combination of Groups 1 and 2 collection systems to a combination of Groups 2 and 3 when moving from the baseline to full implementation. The difference between assumed collection systems is large in 2020 and diminishes thereafter.

Figure 60 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



KS: kerbside collection

PAYT: pay as you throw

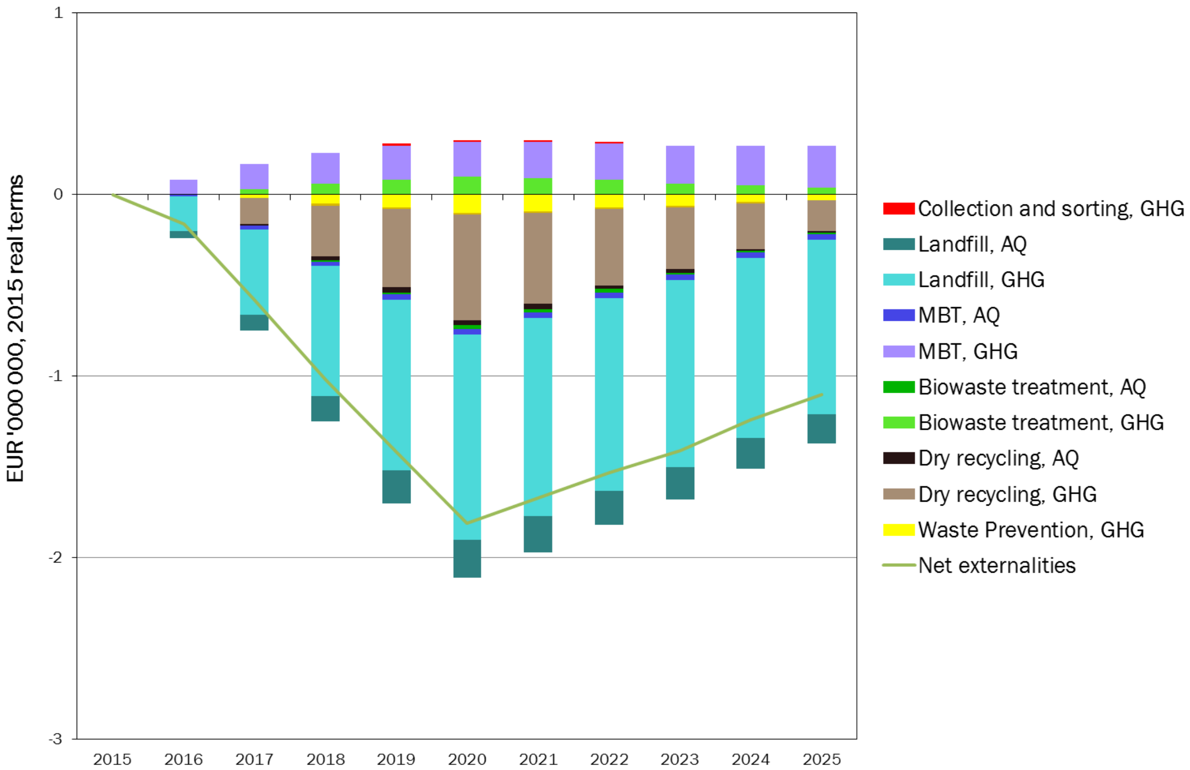
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 61 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are those in Figure 58.

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHG emissions from landfill and recycling[11] in the full implementation scenario. In addition, avoided externalities related to emissions of other air pollutants from landfill, MBT and recycling influence this result. There are, however, external costs caused by higher GHG emissions from MBT treatment in the full implementation scenario.

The graph shows maximum avoided externalities related to full implementation in comparison with the baseline in 2020. The significant difference is mainly due to impacts related to GHGs and other air pollutant emissions from landfill in 2015–2020. The difference between the scenarios decreases slightly after 2020 due to decreasing avoided GHG emissions related to dry recycling, because the share of recycling in the baseline scenario moves closer to that of full implementation.

Figure 61 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline scenario, 2015–2025



9.3.2 Employment

Figure 62 shows a net creation of additional employment under the full implementation scenario. While some jobs are lost at landfill sites, more are created in MBT plants and especially through recycling activities (collection and processing). The difference in employment between the two scenarios diminishes after 2020, as do the costs.

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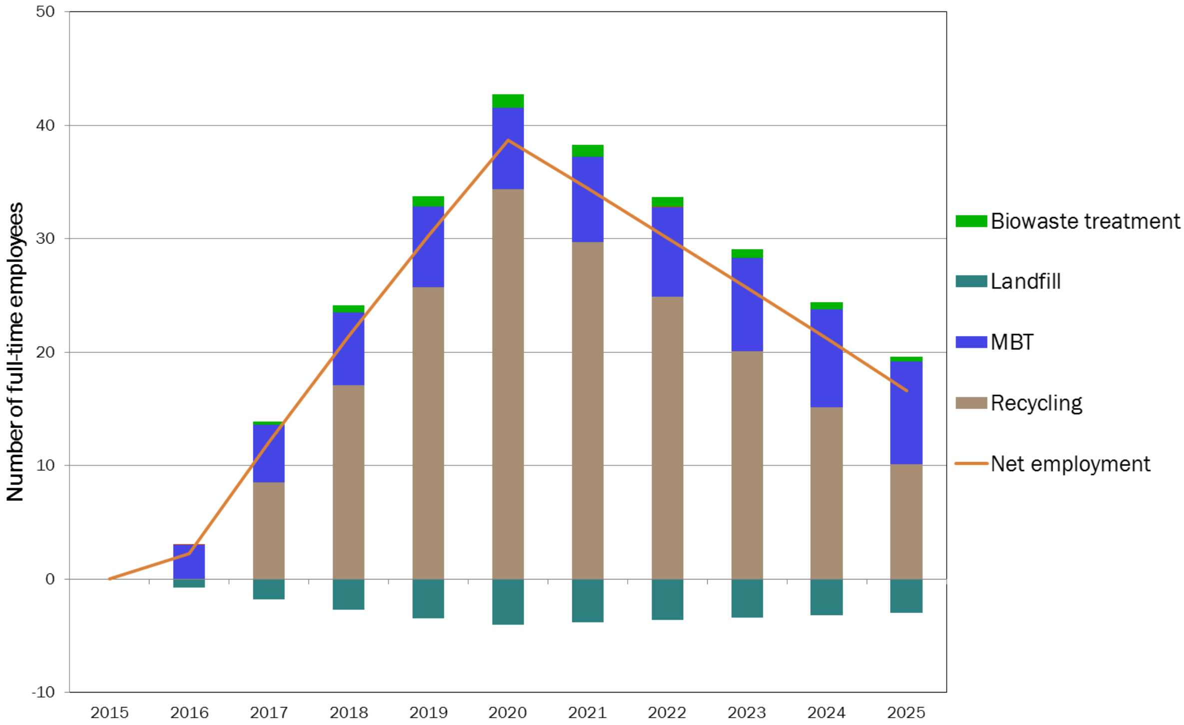
11 More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 62 Differences in the number of full-time employees in the full implementation

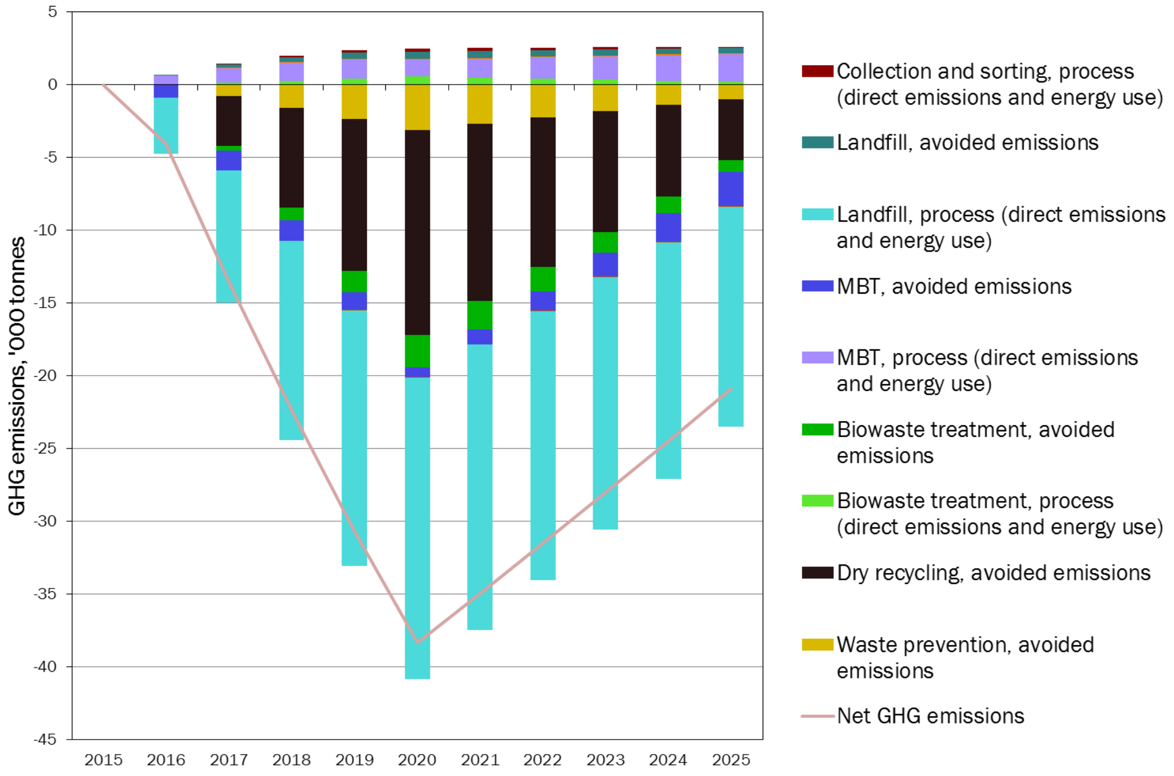


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

9.3.3 Greenhouse gas emissions

Figure 63 shows a significant net decrease in GHG emissions in the full implementation scenario. The largest amounts of avoided GHGs come from less MSW being sent to landfill. Avoided emissions from dry recycling increase up to 2020, and avoided emissions from MBT are slightly higher than process (direct) emissions. Thereafter the differences diminish.

Figure 63 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

9.3.4 Conclusion

Malta is at risk of missing the WFD 2020 recycling target, illustrated by a modelled recycling rate of 41 per cent in 2020, and 31 per cent following a customised modelling method that better reflects the planned measures regarding separate collection of biowaste and dry recyclables.

When moving from the baseline to full implementation, recycling and MBT treatment rates increase.

The full implementation scenario would bring increased costs related to MBT and collection. It will also bring higher employment, mainly in recycling and MBT. Externalities are reduced when moving from the baseline to full implementation mainly because of avoided emissions from landfill.

10 Poland

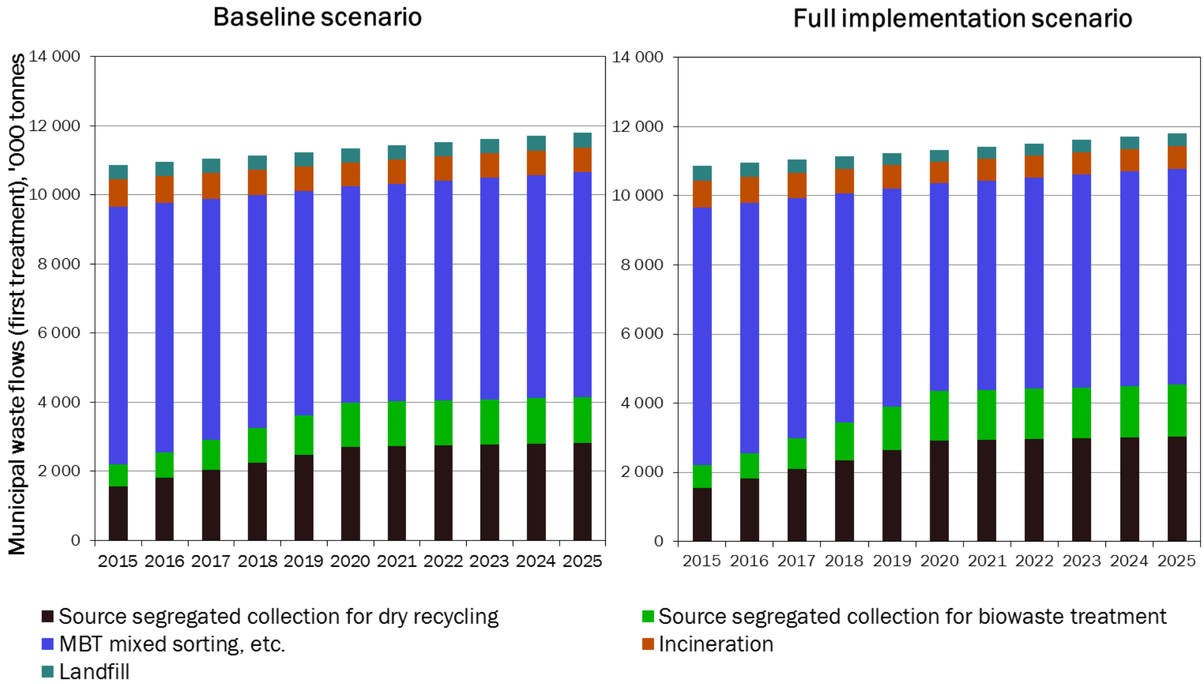
10.1 Development in the destinations of municipal solid waste

Figure 64 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

The generation of MSW is projected to increase continuously between 2015 and 2025 (Figure 64). Poland treats a large share of MSW in MBT plants as a first treatment step, and this share is expected to decrease in both scenarios while the amounts collected for recycling and biowaste treatment increase.

Overall, the combination and share of destinations (separate collection for dry recycling and biowaste treatment, incineration, MBT and landfill) in the two scenarios are very similar.

Figure 64 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

10.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 23 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline modelling, under Method 2 Poland will achieve a recycling rate of 47 per cent by 2020. As no further policy measures are known to be firmly planned after 2020, the baseline scenario assumes no further changes to waste management, so the recycling rate stays constant up to 2025. This is, of course, a pessimistic view, and Poland might be expected to plan additional measures if it falls short of the 2020 target. However, these are not known and are thus not included in the baseline scenario.

Table 23 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	27	31	35	39	43	47	47	47	47	47	47

Table 24 compares model calculations and reported data for 2015. The recycling rate reported by Poland is quite similar to the one calculated by the model.

Table 24 Comparison of model calculations and Poland's reported recycling rates according to the chosen method, 2015

Method 2	2015
Recycling rate calculated by the model (%)	27
Reported recycling rate (%)	26

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

Table 25 shows the absolute amounts of waste. The results calculated by the model are quite similar to the reported amounts.

Table 25 Comparison of modelled calculations and Poland's reported amounts of waste generated and recycled, 2015

Method 2	Generated	Recycled
Amounts calculated by the model ('000 tonnes)	3 911	1 047
Reported amounts ('000 tonnes)	3 998	1 041

10.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Poland moves from the baseline to the full implementation scenario in 2015–2025 (full implementation scenario minus baseline scenario).

10.3.1 Environmental externalities and financial costs

Figure 65 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Poland the costs related to full implementation are slightly higher than those related to the baseline scenario up to 2020. Thereafter, the net costs related to full implementation are lower than those of the baseline scenario.

As Poland moves from the baseline towards full implementation, the difference in costs decreases and then stabilises.

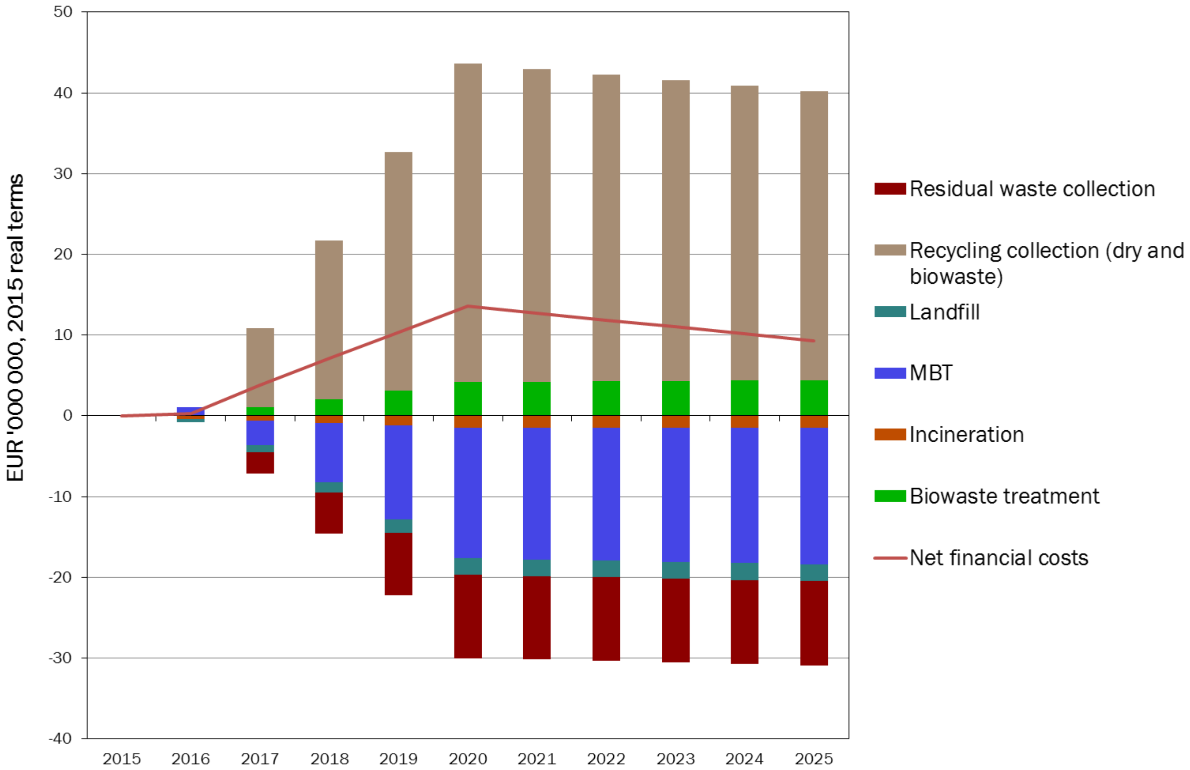
Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios do not change after 2020.

Figure 65 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

Figure 66 shows the split in financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 65.

To reach the 2020 WFD target, the model assumes that a certain amount of waste is diverted from MBT to recycling. This results in lower costs for MBT and higher costs related to biowaste treatment in the full implementation scenario. Costs for collection also change when moving to the full implementation scenario because the model assumes that higher recycling rates require the use of more sophisticated collection systems with higher overall costs.

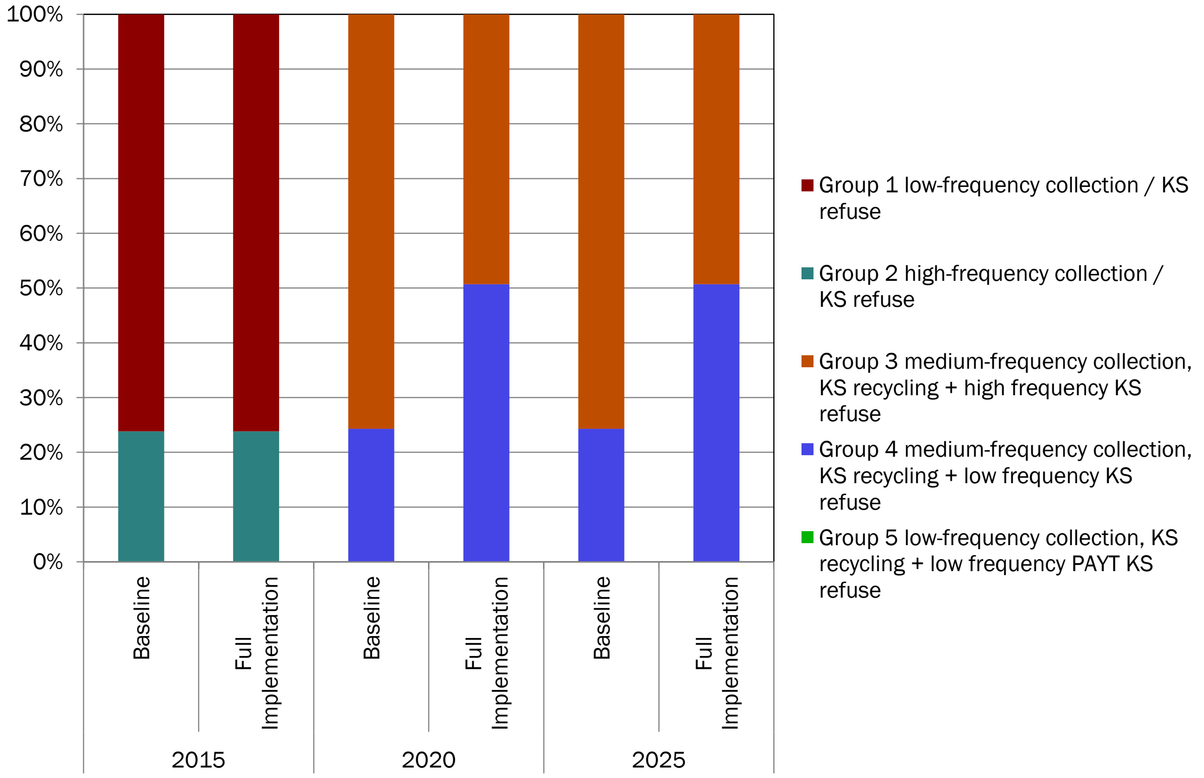
Figure 66 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline scenario, 2015–2025



Box 10 Poland's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of refuse (residual waste), except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Poland, although the differences in recycling rates between the two scenarios are relatively small in 2020, the model assumes a change in the ratios of Groups 3 and 4 collection systems when moving from the baseline to full implementation. As no change is expected after 2020 the differences between the scenarios stay the same after 2020.

Figure 67 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households

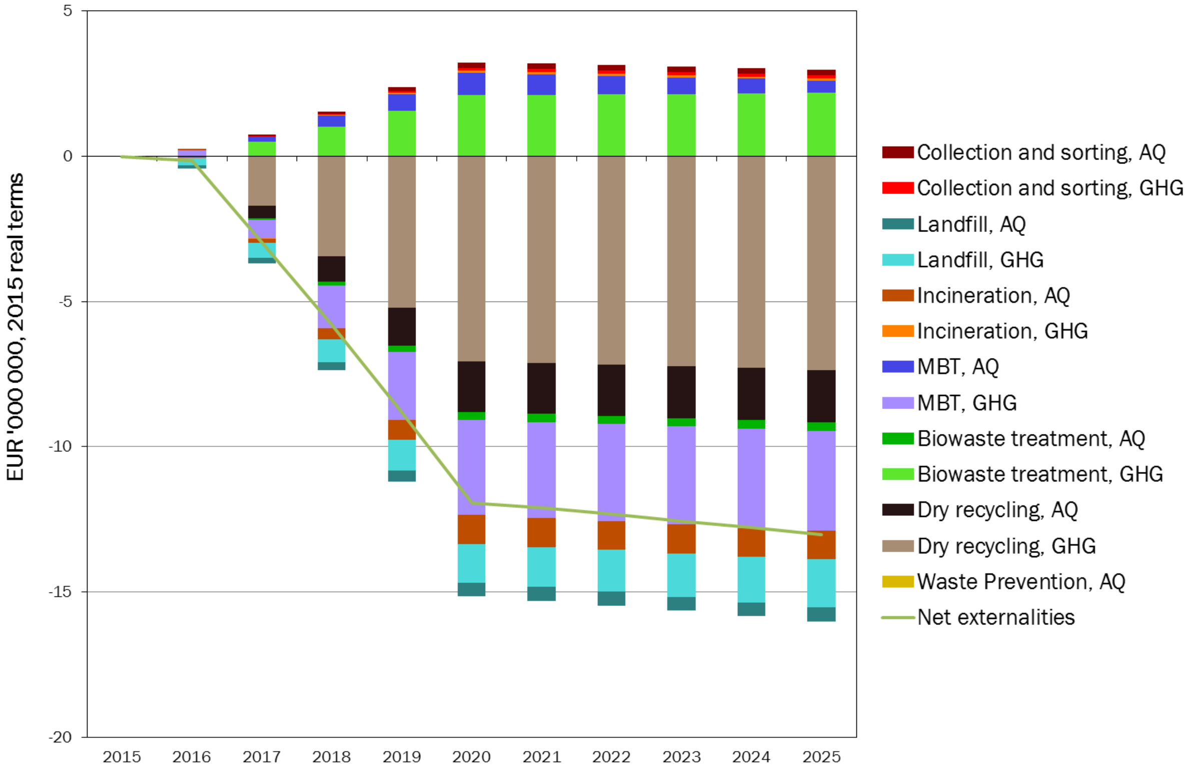


KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 67 shows maximum avoided externalities related to full implementation in comparison with the baseline in 2020. The externalities indicated in this graph (green line) are those in Figure 65.

The difference is mainly due to the combined effect of avoided GHGs and other air pollutants related to dry recycling[12] and MBT in 2015–2020. In the period 2020–2025, the difference in avoided externalities does not change because the two scenarios remain largely constant – there are only small changes due to an increase in MSW generation.

Figure 67 Differences in externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025

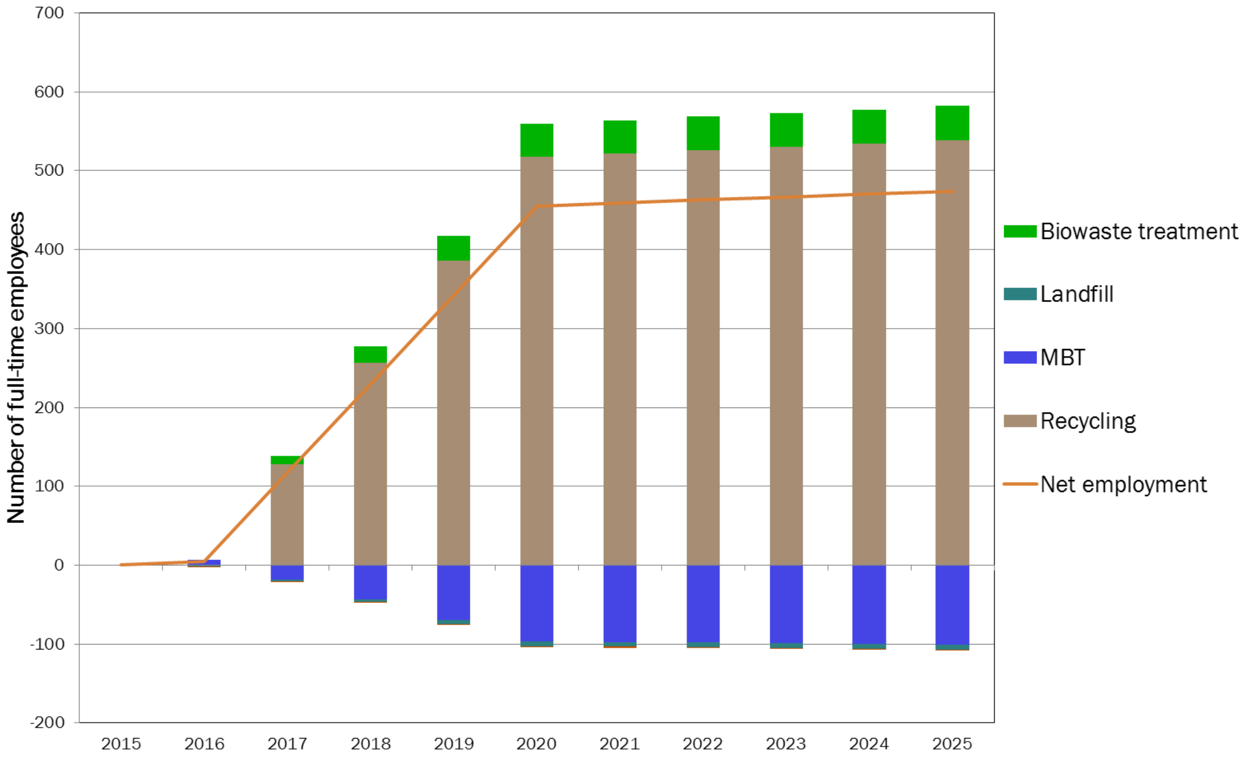


10.3.2 Employment

Figure 68 shows a net creation of additional jobs under the full implementation scenario. While some jobs are lost at MBT plants, more are created through recycling and biowaste treatment. The difference in employment between the two scenarios barely changes after 2020.

12 More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 68 Differences in the number of full-time employees in the full implementation



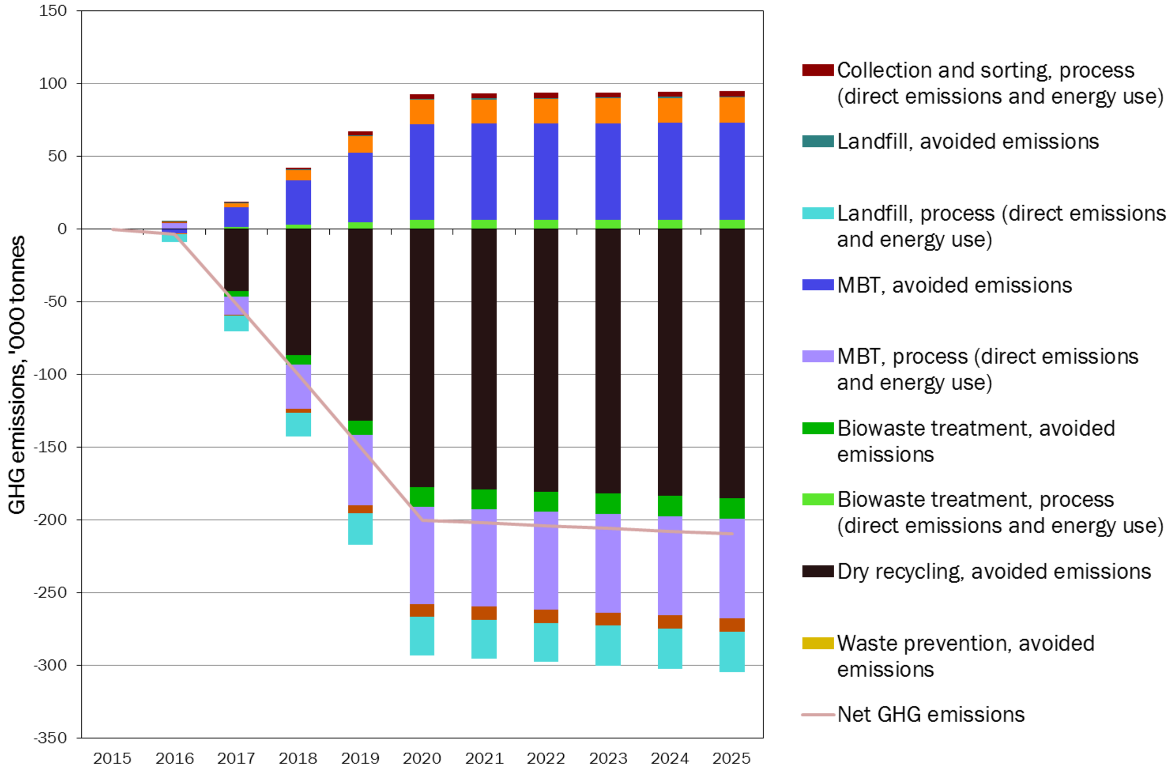
Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

10.3.3 Greenhouse gas emissions

Figure 69 shows a rapid decrease in GHG emissions in the full implementation scenario up to 2020. The largest amount of avoided GHGs results from more waste going to recycling[13].

[13] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 69 Differences in greenhouse gas emissions in the full implementation



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

10.3.4 Conclusion

Poland is at risk of missing the 2020 WFD recycling target, illustrated by a modelled recycling rate of 47 per cent in 2020. It is, however, close to the target.

When moving from the baseline to full implementation, both recycling and MBT rates increase.

The full implementation scenario would bring increased collection costs. It will also bring higher employment mainly in recycling and biowaste treatment. Externalities are reduced when moving from the baseline to full implementation.

11 Portugal

11.1 Development in the destinations of municipal solid waste

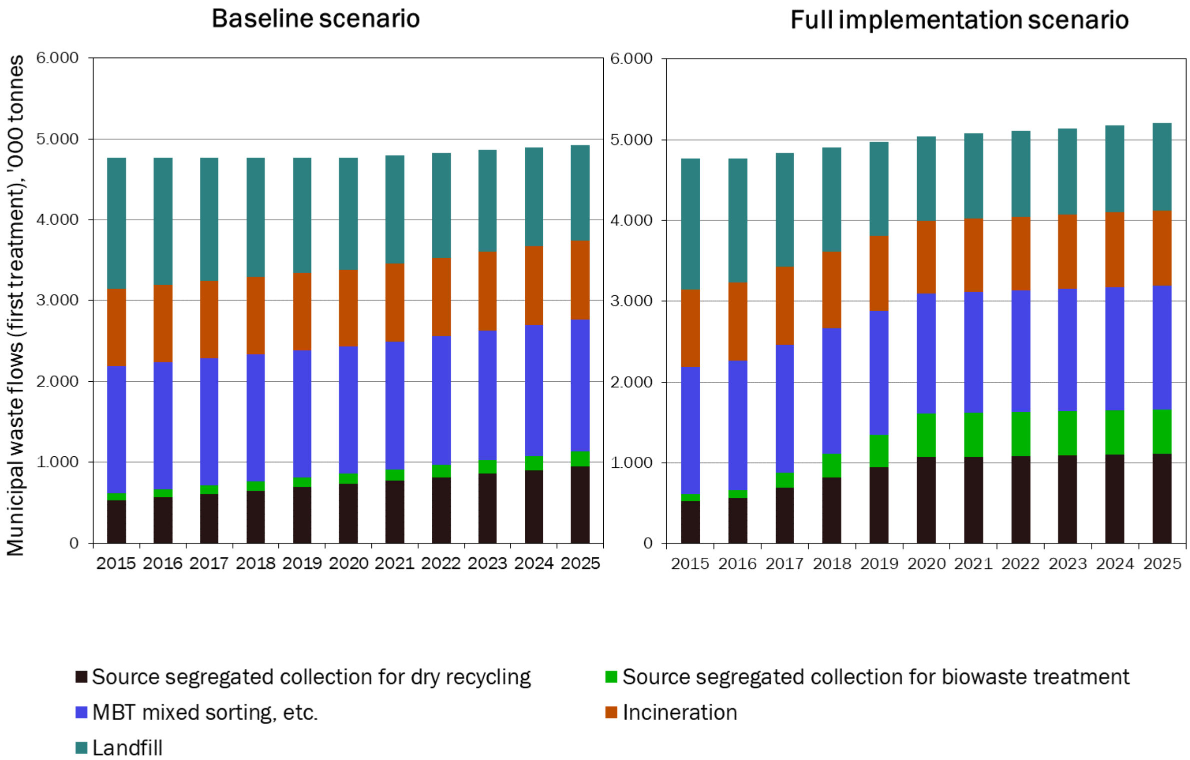
Figure 70 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

Portugal's generated amount of MSW is projected to increase up to 2025. Under the full implementation scenario, the amount of waste generated increases more than in the baseline scenario due to the changes in the collection systems (Box 11), and because the model assumes that the amount of garden waste generated and treated increases when households are offered separate collection of biowaste.

The full implementation scenario optimises waste management so that the targets are met on time. By default, the model does not take compost from MBT plants into account when calculating the recycling rate. However, Portugal indicated that compost from MBT is counted as being recycled towards the recycling target of the WFD. The optimisation procedure for the full implementation scenario does not take into account MBT-derived compost as recycled and cannot therefore fully reflect Portugal's method in the calculations for a full implementation scenario.

The share of MSW separately collected for dry recycling and biowaste increases steadily in the baseline scenario, while under the full implementation scenario it increases faster up to 2020 and thereafter stays constant.

Figure 70 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

Under both scenarios the amount of waste Portugal sends to landfill will decrease, with full implementation reaching a lower share in 2020 driven by the need to meet the Landfill Directive's target, and staying constant thereafter due to the assumptions underlying the full implementation scenario. The shares of incineration and waste sent to MBT are roughly constant in the baseline scenario and under full implementation, but are lower in the latter case.

During 2015–2025, the amount of waste diverted from landfill in the baseline scenario is almost completely related to an increase in dry recycling. This comes from the assumed effects of planned policies to increase dry recycling while no further incineration and MBT capacity is expected.

Under full implementation, the additional decrease in landfill, and the small increase in MBT, are coupled with increases in collection for dry recycling and biowaste treatment. The larger landfill diversion is driven by the EU's 2020 landfill diversion target of 35 per cent of the amount of biodegradable municipal waste generated in 1995. The explanation for the evolution of the specific shares can be found in the waste types that are accounted for using Method 2[14], leading to an increase in separate collection of dry recyclables and biowaste under full implementation up to 2020, as they contribute to target achievement.

[14] Paper, glass, metals, plastics, biowaste (including stabilised output from MBT plant), wood, WEEE from municipal sources.

11.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 26 shows the modelled recycling rate according to the chosen method. By default, the model makes assumptions about which waste fractions are included in the recycling rate, which may differ from the fractions used by the Member State, and the model does not take stabilised output from biodegradable waste from MBT plants into account when calculating the recycling rate. However, Portugal indicated that such MBT output is counted as being recycled towards the recycling target of the WFD. Table 27 shows that the default calculation of method 2 cannot fully reproduce the reported recycling rate.

Therefore, additional calculations have been performed to better reflect the method applied by Portugal for compliance with the recycling target: in the second row in Table 26, the recycling rate is calculated taking into account all fractions that Portugal accounts for when reporting against the target[15]. In the model, this means that MBT output generated from paper, wood and biowaste that is otherwise by default allocated to landfill and to energy recovery in the model, is added to the recycling rate. Using the default method to calculate the recycling rate for method 2 and based on the assumptions made in the baseline scenario, under Method 2 Portugal will achieve a recycling rate of 34 per cent by 2020, and 40 per cent by 2025. If the calculation of method 2 is customised to include all MSW fractions taken into account by Portugal for the reporting of the recycling rate, including stabilised biodegradable waste from MBT, the recycling rate is 35 per cent by 2020 and 39 per cent by 2025.

Table 26 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 2	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	27	28	30	31	32	34	35	36	37	38	40
Customised recycling rate, incl. stabilised output from MBT plants (%)	31	32	33	35	36	35	36	36	37	38	39

Table 27 Comparison of modelled calculations and Portugal's reported recycling rates according to the chosen method, 2015

Method 2	2015
Recycling rate (%)	27
Recycling rate calculated using customised method (%)	31
Reported recycling rate (%)	32

15 Paper, glass, metals, plastics, biowaste (including stabilised output from MBT plant), wood, WEEE from municipal sources.

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

11.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Portugal moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

11.3.1 Environmental and financial costs

Figure 72 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of greenhouse gases (GHGs) and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Portugal the costs related to the full implementation scenario are higher than those for the baseline scenario, and that the net costs are driven by the financial costs.

As Portugal moves from the baseline scenario towards full implementation, the difference in costs increases. The difference decreases slowly after 2020, because the full implementation scenario stabilises after 2020 while the baseline scenario moves closer to it (Figure 70).

Externalities in the full implementation scenario are lower than in the baseline, showing that environmental benefits arise when moving away from the baseline scenario.

Figure 71 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

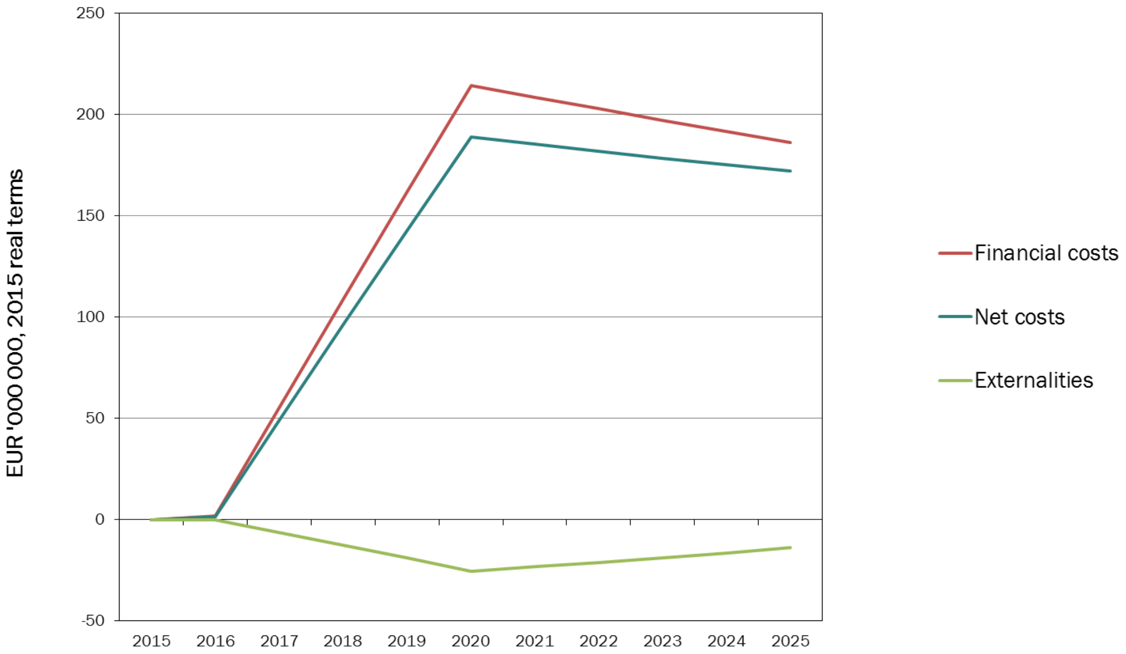
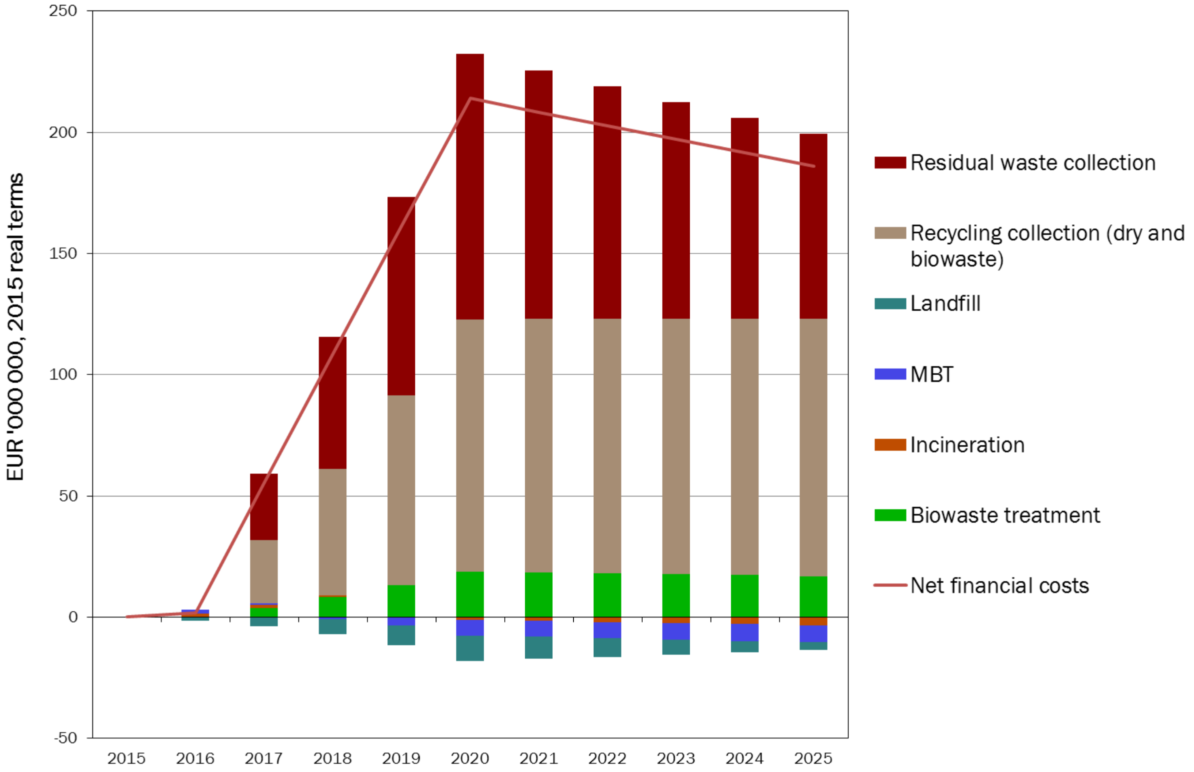


Figure 72 shows the split of costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 71.

To reach the EU Landfill Directive's diversion target, the model assumes that a certain amount of waste is diverted away from landfill. This results in lower landfill costs in the full implementation scenario; on the other hand, as collection for recycling and biowaste treatment are larger under full implementation, the resulting costs are also larger. Waste collection costs also increase in relation to residual waste.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. The increase in costs up to 2020 when moving from the baseline to full implementation is mainly driven by collection costs. Residual waste collection costs increase because the model assumes a move from very basic collection systems with low-frequency bring sites for residual waste, to collection of residual waste with higher-frequency door-to-door collection. Collection costs for recycling increase because more waste is separately collected for recycling and biowaste treatment in the full implementation scenario, and because of the modelled introduction of door-to-door separate collection systems for individual households and higher-density bring sites for recyclables (for flats) (Box 11). The difference between the scenarios diminishes after 2020, mainly driven by decreasing cost differentials for residual waste collection.

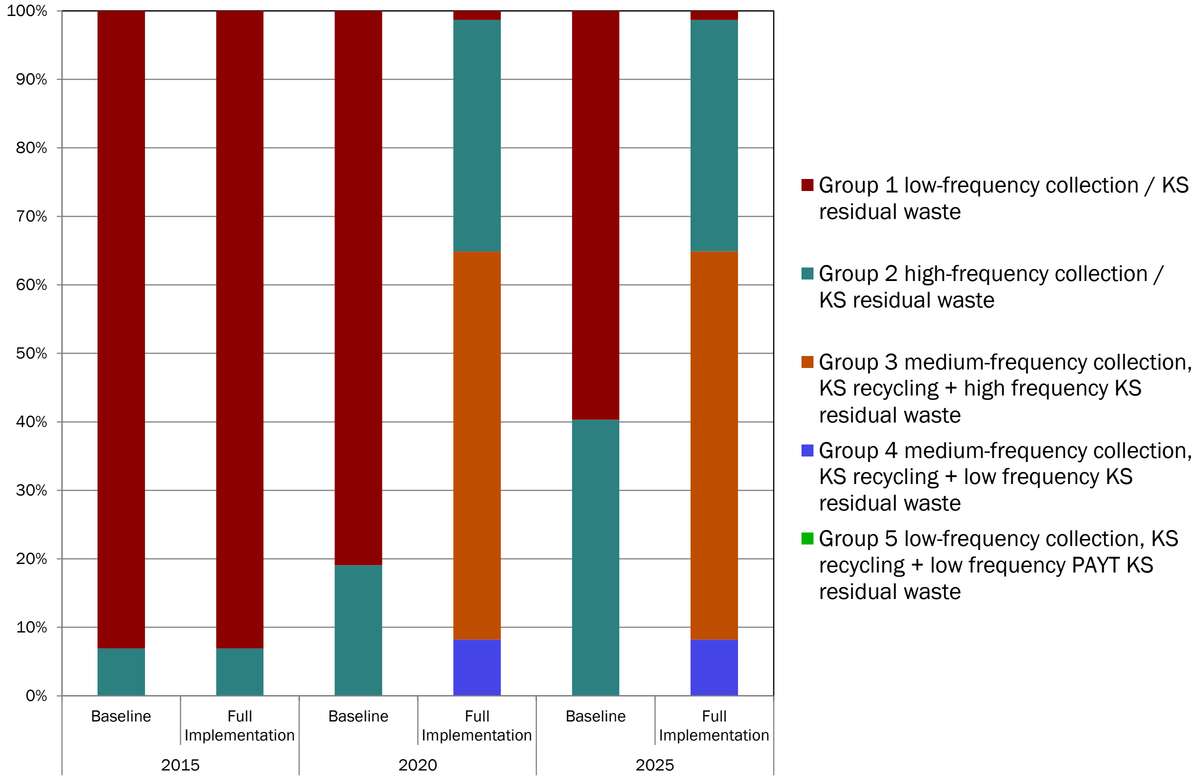
Figure 72 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 11 Portugal's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of residual waste collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Portugal, as shown in Figure 74, recycling rates differ between the baseline and full implementation scenarios. This implies, under full implementation, a significant restructuring of collection systems from Groups 1 and 2 to Groups 3 and 4, towards systems in which kerbside recycling is present, as compared to the baseline. After 2020, no further changes in collection systems occur under full implementation. In the baseline scenario, on the other hand, the share of Group 2 over Group 1 increases between 2015 and 2025.

Figure 73 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households

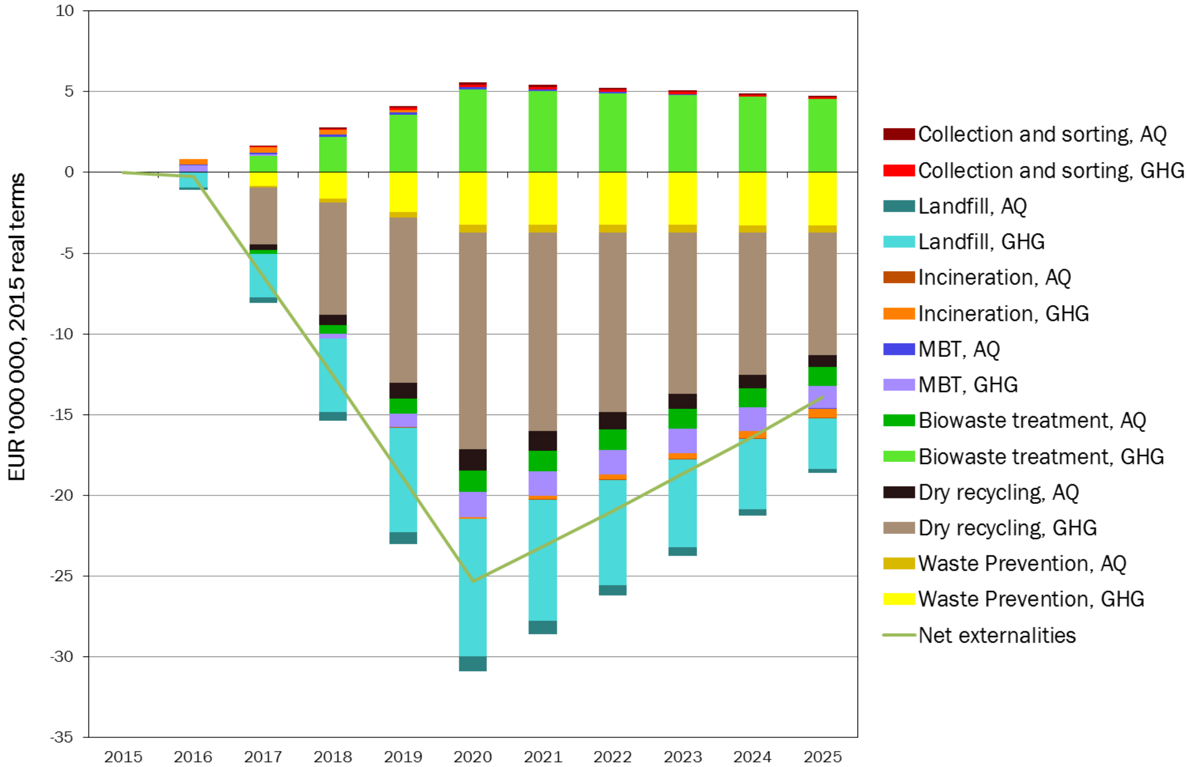


KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: [Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling](#).

Figure 74 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The net externalities indicated in this graph (as a green line) are the same as those in Figure 71.

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHG emissions and to a smaller extent emissions of other air pollutants resulting from reductions in landfill, and from increases in avoided emissions from dry recycling[16] in the full implementation scenario, only partially counteracted by increases in GHGs due to additional biowaste treatment. The waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste leads to higher awareness amongst citizens, resulting in a small prevention effect. After 2020, the differences between the two scenarios diminish, as the baseline scenario moves closer to the full implementation scenario.

Figure 74 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



AQ: air quality
GHG: greenhouse gases

11.3.2 Employment

Figure 75 shows a net creation of additional jobs under the full implementation scenario. Some jobs are lost at landfill sites and in MBT plants, but more are created in recycling and, to a lesser extent, in biowaste treatment. As with the costs, the differences between the two scenarios diminish after 2020.

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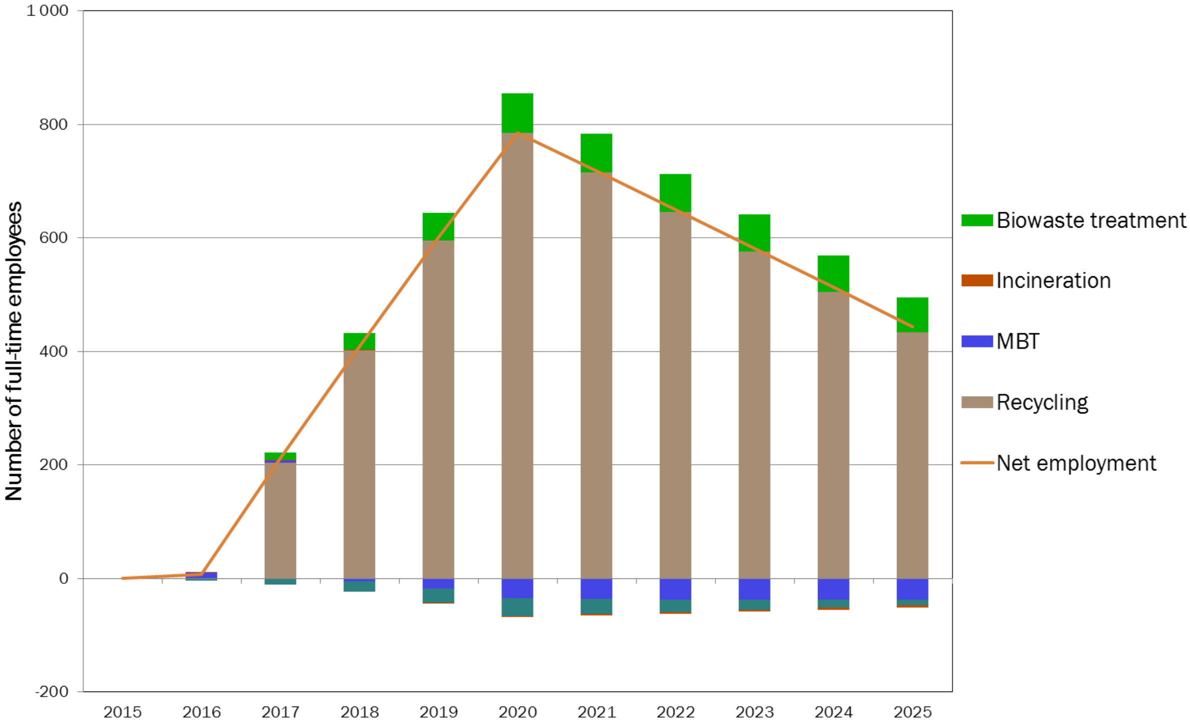
16 More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 75 Differences in the number of full-time employees in the full implementation scenario compared to the baseline, 2015–2025

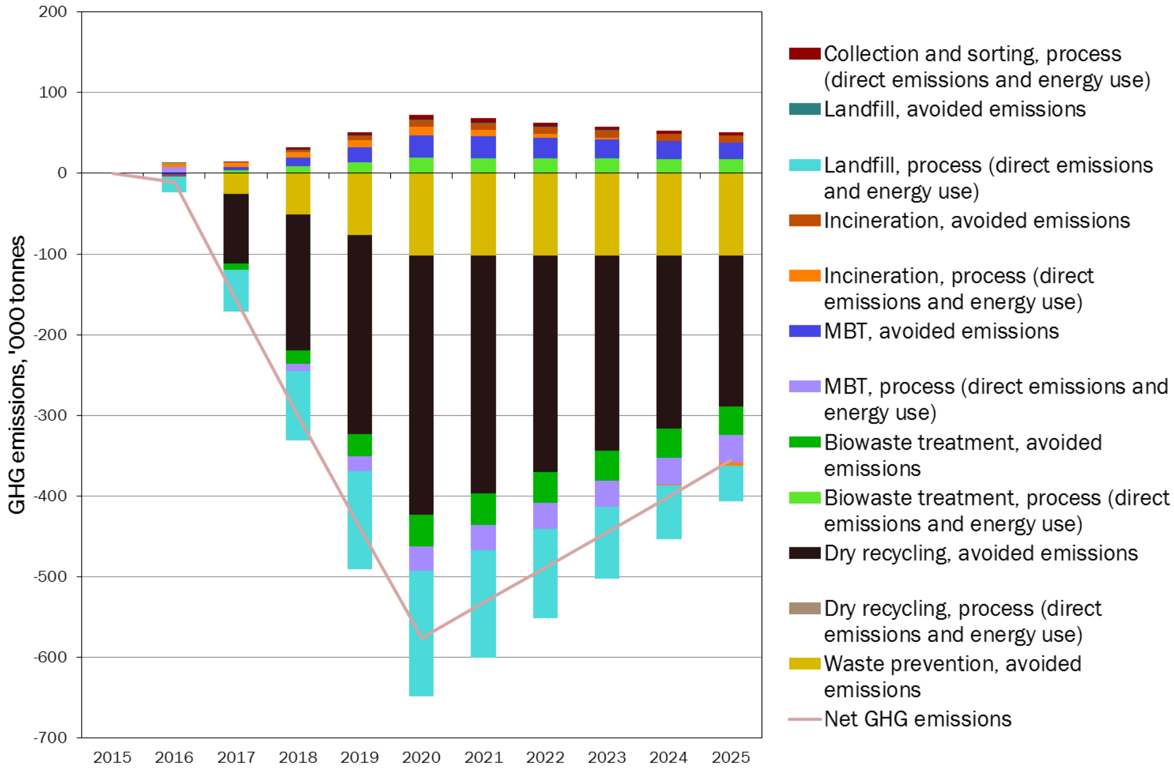


Note: Employment for residual waste collection is included in MBT, and employment for separate collection is included in recycling and biowaste treatment.

11.3.3 Greenhouse gas emissions

Figure 76 shows a significant decrease in net GHG emissions in the full implementation scenario as compared to the baseline case. The largest reductions in GHG emissions result from more dry recycling and less waste being sent to landfill. It is also worth noting that direct emissions from collection are slightly higher under full implementation, as might be expected from the evolution of collection systems (Box 11).

Figure 76 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

11.3.4 Conclusion

Portugal is at risk of missing the 2020 WFD recycling target, illustrated by a modelled 2020 recycling rate in the baseline scenario of 34 per cent, and 35 per cent when calculated by taking into account all fractions included by Portugal in the reporting against the target (incl. stabilised biodegradable waste from MBT plants).

Comparing the baseline scenario with the modelled results of the full implementation scenario, it is clear that Portugal has to further decrease landfill and increase collection for dry recycling and biowaste treatment. Restructuring of the collection systems is also suggested by the full implementation scenario. It has to be kept in mind, however, that the full implementation scenario in the model currently cannot fully reflect the method Portugal uses to report compliance against the target.

The full implementation scenario is expected to bring reduced externalities, as well as increased employment, mainly in the recycling sector. At the same time, the financial costs are higher under full implementation.

12 Romania

12.1 Development in the destinations of municipal solid waste

Figure 77 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

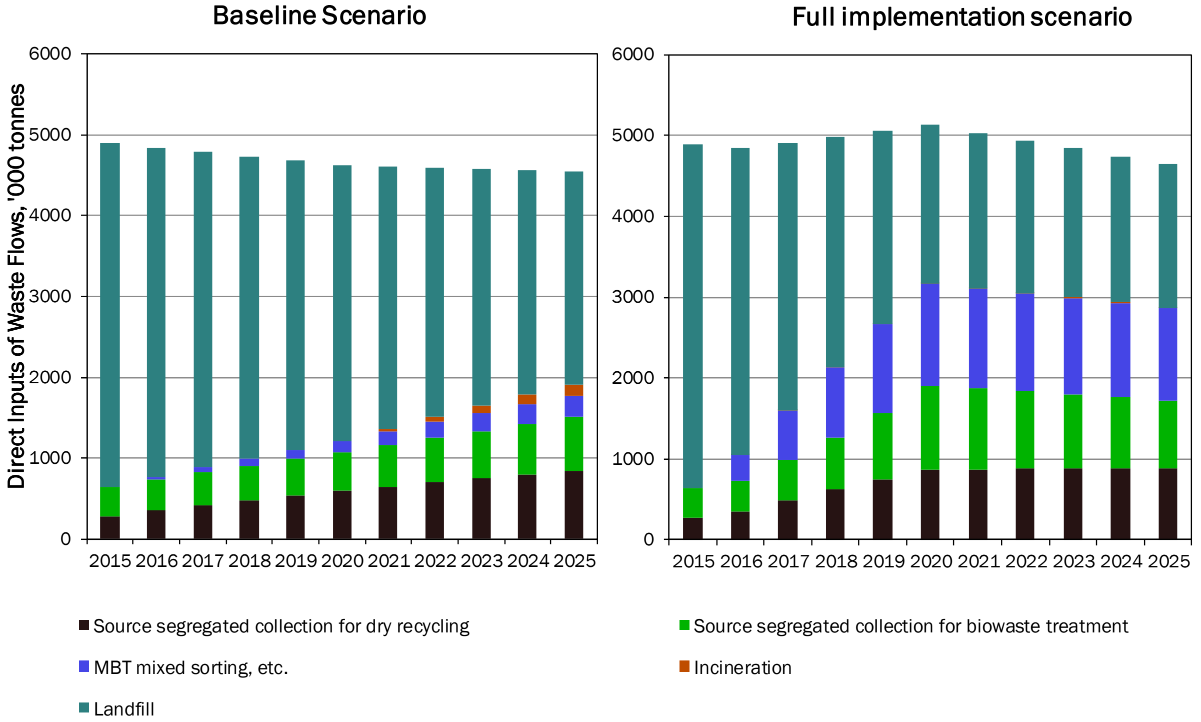
The ETC/WMGE has provided a waste generation projection for Romania which assumes a slight but steady reduction up to 2025. However, under full implementation waste generation increases slightly between 2016 and 2020 and then falls. This development is inherent to the modelling framework as it assumes an increase in collected amounts of garden waste once the separate collection of biowaste is offered to more households.

Under both scenarios the share of waste collected for dry recycling and biowaste treatment will increase but at a lower level in the baseline scenario. In the full implementation scenario, the needed increase in waste collected for recycling and biowaste treatment results in a decrease in landfill. No further changes are foreseen in this scenario after 2020 as the targets are reached in 2020.

Under both scenarios the amount of waste Romania sends to landfill will decrease and the amount sent to MBT will increase. The major decrease in landfill up to 2020 in the full implementation scenario is driven by the 1999 Landfill Directive diversion target that Romania has to meet by 2020 (reduction of biodegradable municipal waste landfilled to 35 per cent of that generated in 1995). Driven by full implementation of the Landfill Directive diversion targets, under the full implementation scenario both the speed of change and the amounts sent to MBT will be significantly greater than in the baseline scenario.

Under the baseline scenario waste incineration will be introduced after 2020 as Romania is planning to build waste incineration capacity that will only then become available; this is not taken into account in the full implementation scenario as this scenario is by definition kept constant after 2020.

Figure 77 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

12.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Until 2015, Romania reported according to Method 4, but has indicated its intention to change to Method 2[17]. Table 28 shows the modelled recycling rate according to Method 2 and Method 4. Based on the assumptions made in the baseline scenario, under Method 2, Romania will achieve a recycling rate of 26 per cent by 2020 and 40 per cent by 2025. Romania is therefore at risk of missing the target.

Table 28 Calculated recycling rates according to the chosen methods in the baseline scenario, 2015–2025

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Method 2 (%)	7	12	15	19	22	26	28	31	34	37	40

[17] E-mail from the European Commission to the EEA dated 9 October 2017.

Method 4 (%)	12	14	15	17	19	21	22	24	26	28	30

Table 29 compares modelled calculations and reported data. The recycling rate reported by Romania differs slightly from the one calculated by the model for the year 2015. By default, the model makes assumptions about which waste fractions are included in the recycling rate when modelling Method 2, which may differ from the fractions used by the Member State. The difference between Method 4 and Method 2 is due to the inclusion of biowaste in method 4 and exclusion of biowaste in method 2. However, currently reported data show higher amounts of separately collected biowaste than separately collected dry recyclables. The model also calculates the recycling rate by applying a set of reject rates (losses) to the separately collected amounts, although Romania may have differing reject rates. However, even by switching to Method 2, Romania is at risk of missing the WFD 50 per cent recycling target.

Table 29 Comparison of modelled calculations and Romania's reported recycling rates according to the chosen method, 2015

	2015
Recycling rate calculated by the model (Method 2, %)	7
Recycling rate calculated by the model Method 4, %)	12
Reported recycling rate (Method 4, %)	13

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

12.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Romania moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

12.3.1 Environmental externalities and financial costs

Figure 78 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and other selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Romania the costs related to the full implementation scenario are higher than those related to the baseline, and that the net costs are driven by the financial costs. After 2020, the difference in costs between the two scenarios decreases because in the baseline the shares of MSW collected for dry recycling and biowaste treatment increase, while all waste management shares remain stable in the full implementation scenario.

Externalities in the full implementation scenario are lower than in the baseline, enabling environmental benefits to be realised when moving to full implementation. Again, the differences between the two scenarios diminish after 2020.

Figure 78 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

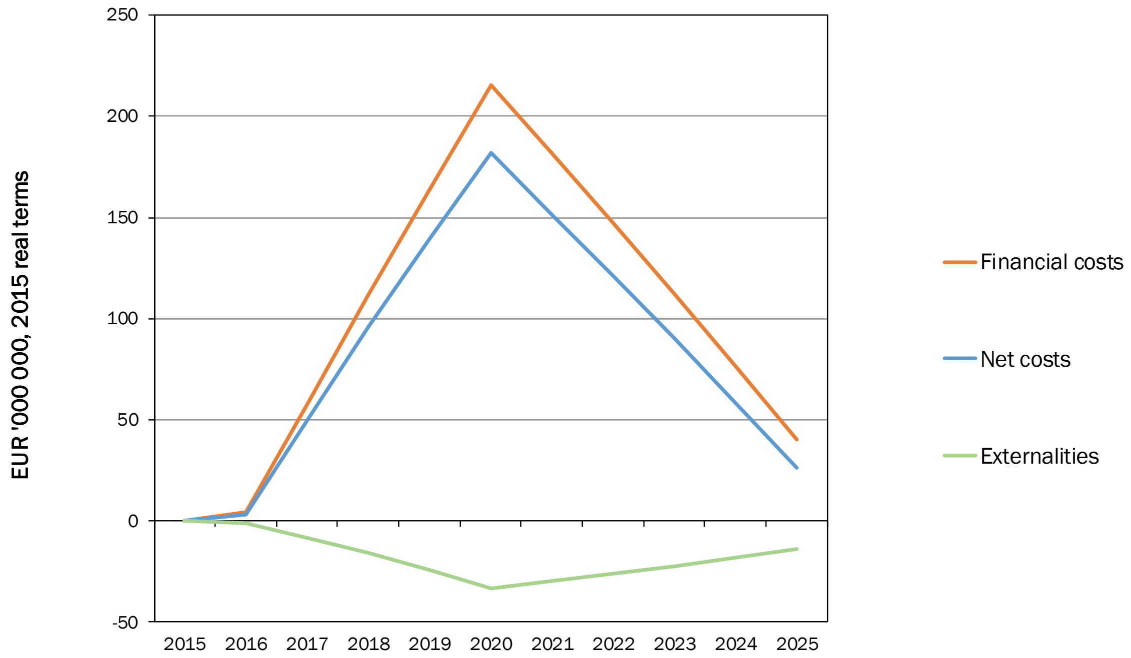
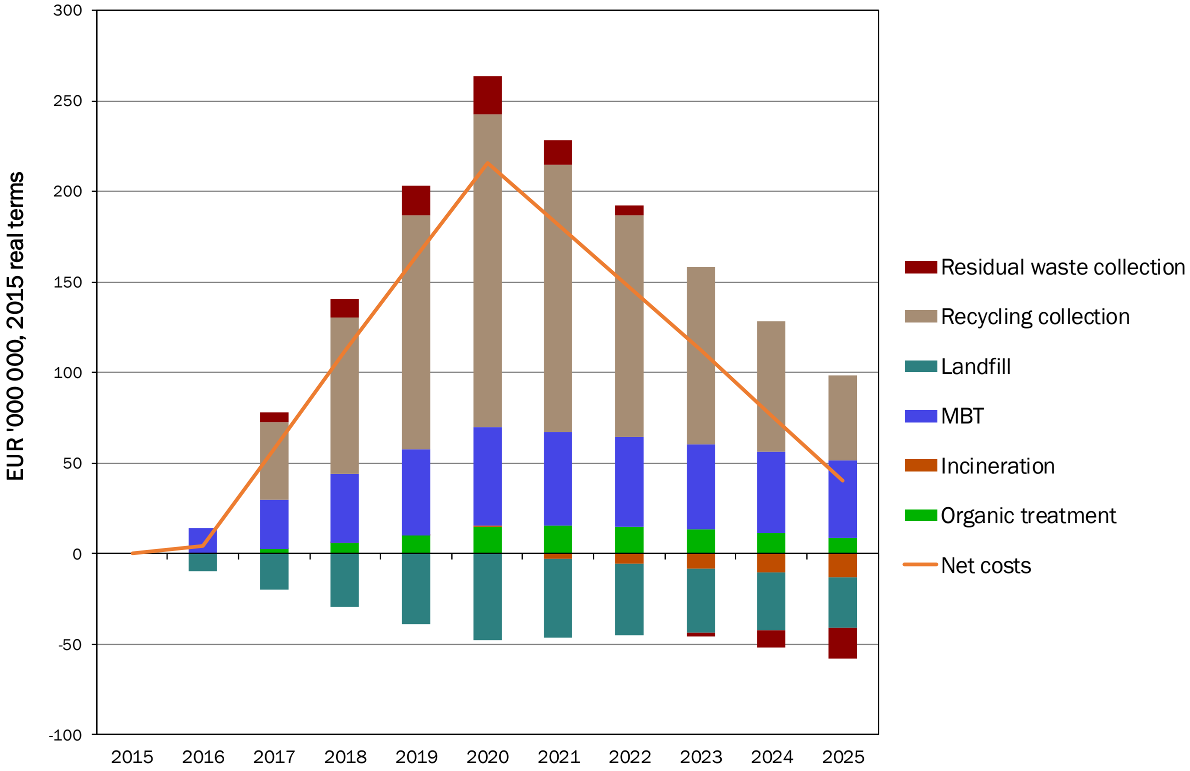


Figure 79 shows the split of financial costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 78Figure .

To reach the EU Landfill Directive's landfill diversion target, the model assumes that a certain amount of waste is diverted from landfill to MBT. This results in higher MBT costs and lower landfill costs in the full implementation scenario; there are also higher costs related to collection for recycling. The residual waste collection costs increase in the full implementation scenario as the waste volumes are assumed to rise. Romania also moves to a more sophisticated collection system in the full implementation scenario, resulting in higher costs for residual waste collection (Box 12).

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then and no further changes occur in waste management. Between 2020 and 2025, the additional costs for collection diminish as the baseline collection rates for recycling move nearer the full implementation rates. By 2025, the costs for collection of residual waste are lower under full implementation than in the baseline scenario because the model assumes a change to collection System 4, which implies less frequent collection of residual waste.

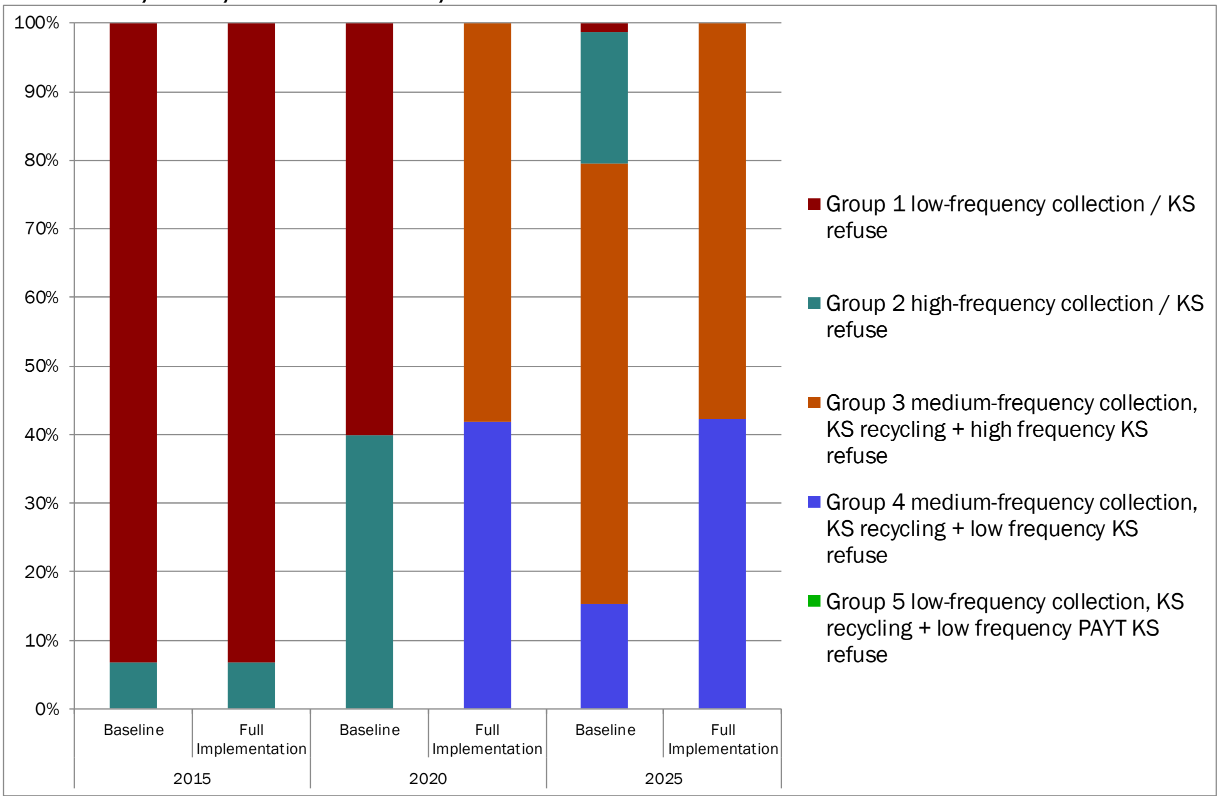
Figure 79 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline scenario, 2015–2025



Box 12 Romania's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of refuse (residual waste), except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of refuse collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Romania, the model assumes a change from Group 1 collection system to a combination of Groups 1 and 2 in 2020 and mainly Groups 2 and 3 in 2025 in the baseline scenario; and towards Group 3 and 4 when moving to the full implementation scenario. The difference between assumed collection systems is large between the two scenarios in 2020 and diminishes thereafter as the difference between baseline and full implementation scenarios decreases.

Figure 80 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



KS: kerbside collection

PAYT: pay as you throw

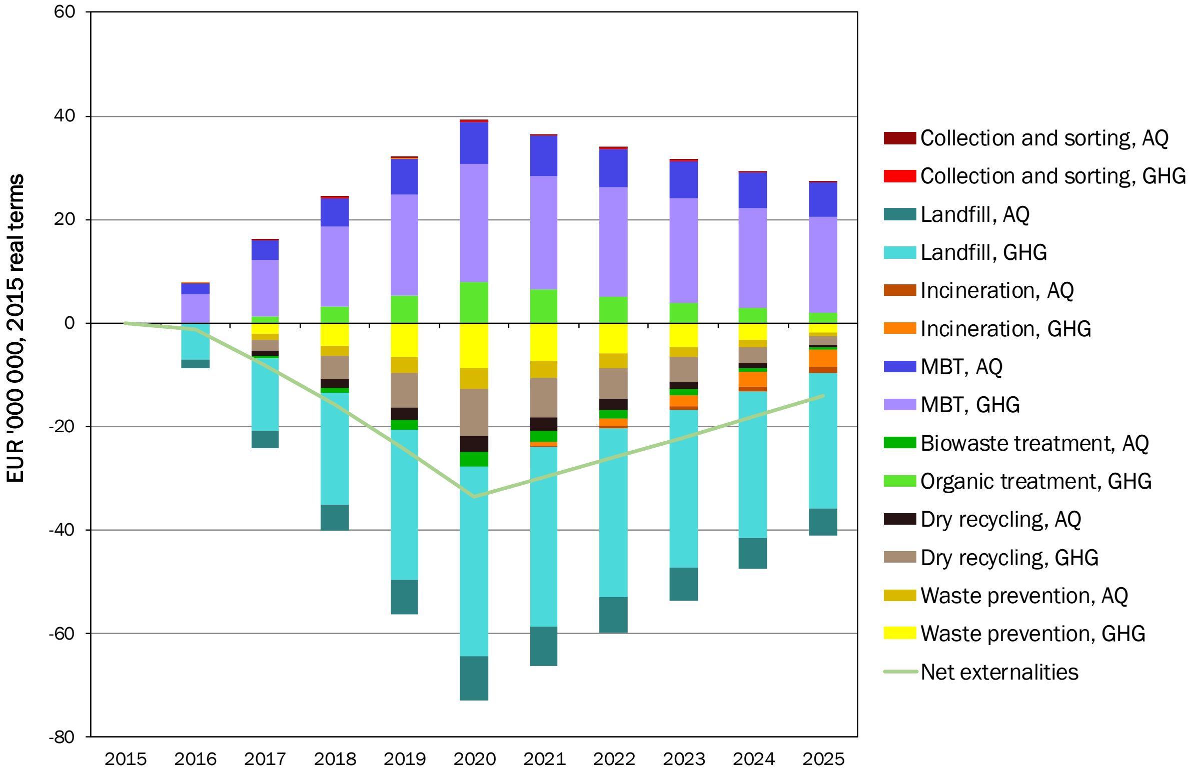
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 81 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are those shown in Figure 78.

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHG and other air pollutant emissions from landfill in the full implementation scenario, but avoided emissions from recycling[18] and waste prevention also contribute to this development. The waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste leads to higher awareness and subsequently to a small prevention effect. There are, however, external costs caused by higher air pollutant and GHG emissions from MBT and biowaste treatment in the full implementation scenario.

The difference in externalities peaks in 2020 because the full implementation scenario assumes that the targets are met by then. Between 2020 and 2025 the baseline scenario moves towards the full implementation scenario and the differences in externalities diminish.

Figure 81 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025

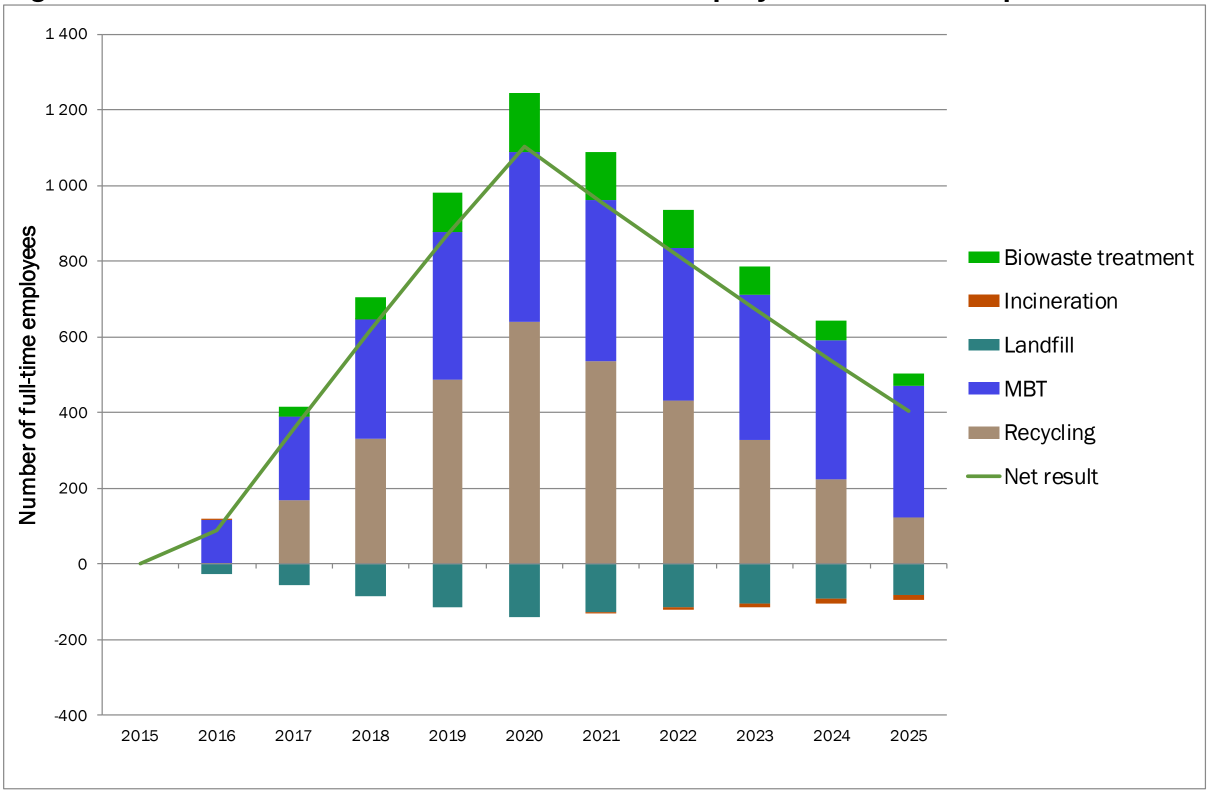


12.3.2 Employment

Figure 82 shows a net creation of additional jobs under the full implementation scenario. While some jobs are lost at landfill sites, more are created at MBT plants and for recycling and biowaste treatment. The difference in employment between the two scenarios diminishes after 2020, as the baseline scenario moves towards full implementation.

18 More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

Figure 82 Differences in the number of full-time employees in the full implementation



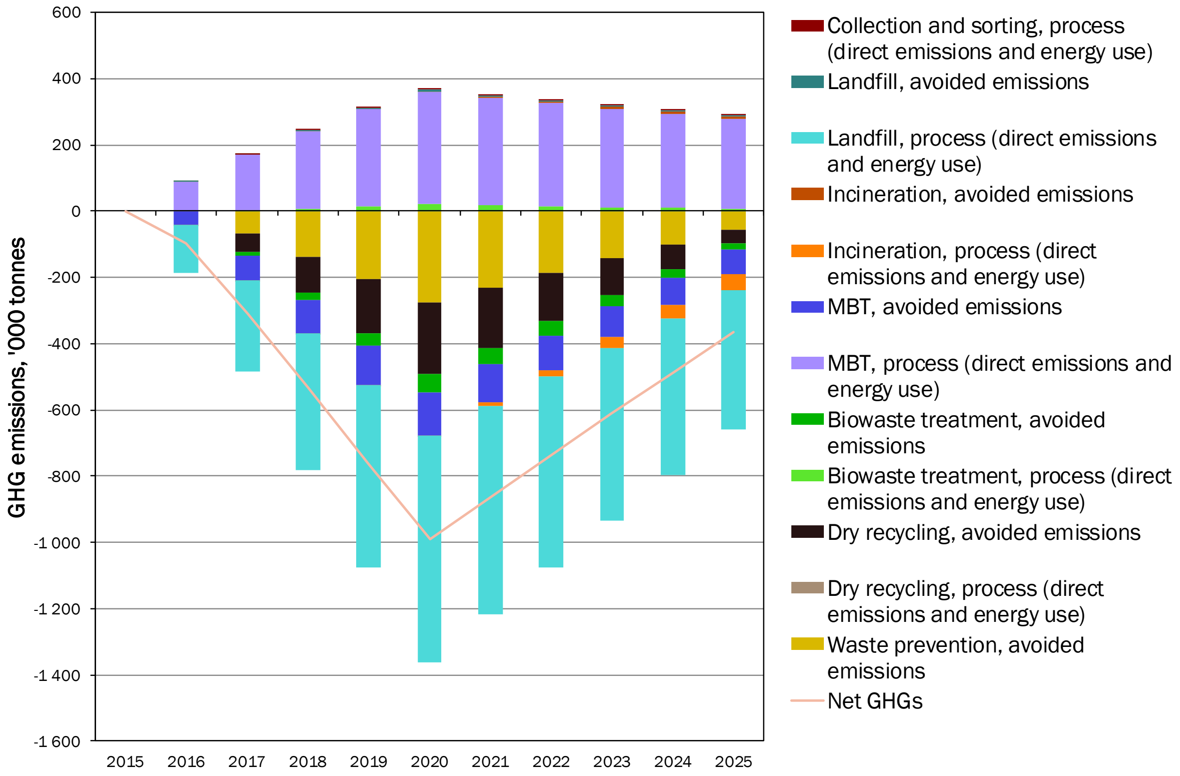
Note: Employment for residual waste collection is included in MBT, and employment for separate collection is included in recycling and biowaste treatment.

12.3.3 Greenhouse gas emissions

Figure 83 shows a significant decrease in net GHG emissions in the full implementation scenario. The largest amounts of avoided GHGs result from less MSW being sent to landfill. Avoided emissions from dry recycling are higher, as well as from biowaste treatment, waste prevention and increased MBT treatment[19]. Increasing MBT volumes generate higher direct GHG emissions from the process.

[19] Higher MBT treatment in the full implementation scenario generates more energy that replaces energy from other sources and thus avoids GHG emissions. More MBT in the full implementation scenario compared to the baseline scenario thus results in more direct emissions and more avoided emissions.

Figure 83 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

12.3.4 Conclusion

Romania is at risk of missing the 2020 WFD recycling target, illustrated by a modelled recycling rate of 26 per cent in the baseline scenario according to method 2, and 21 per cent according to method 4.

In order to achieve the target by 2020, Romania will have to increase recycling and to send less MSW to landfill.

Moving from the baseline scenario to the full implementation scenario would reduce externalities, but would increase financial costs mainly due to increase in costs for separate collection. Employment would increase, mainly in recycling.

13 Slovakia

13.1 Development in the destinations of municipal solid waste

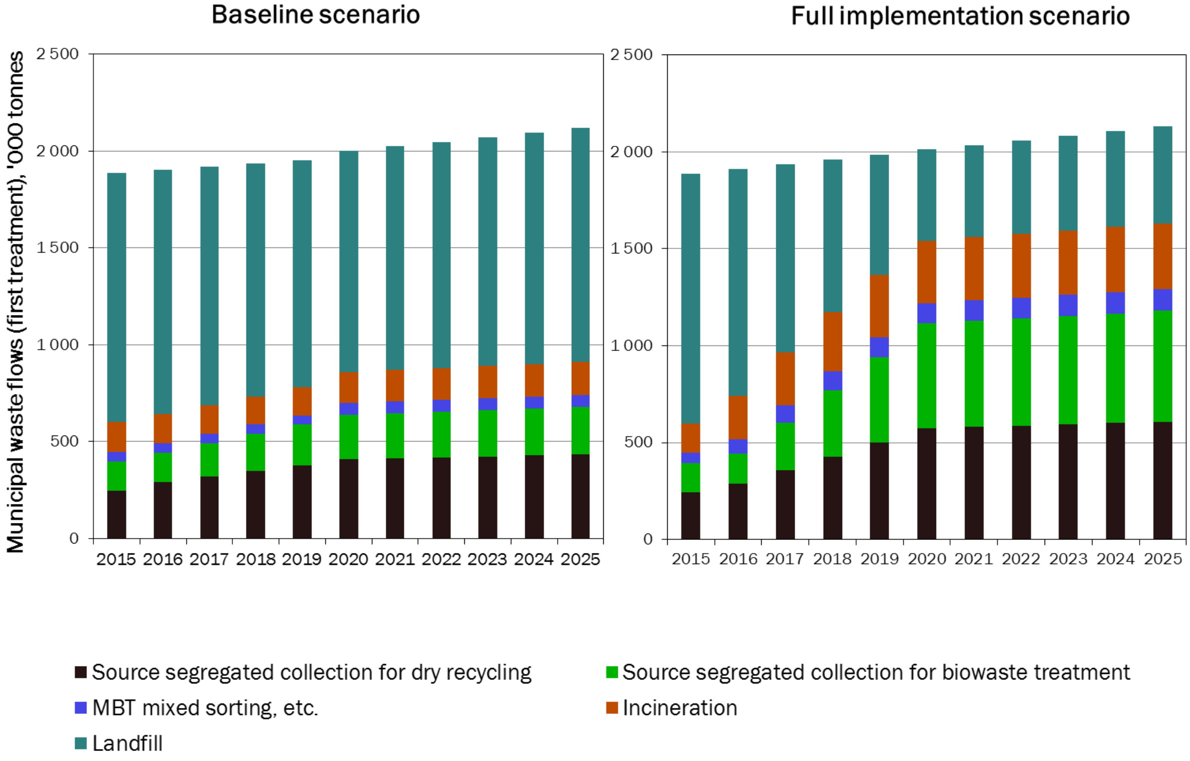
Figure 84 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios. The amount of MSW generated is projected to increase steadily up to 2025 (Figure 84).

The amount of waste Slovakia sends to landfill shows different trends in the two scenarios. More specifically, a significant decrease is expected under full implementation as compared to the baseline scenario. The decrease in landfill in the full implementation scenario is strongly driven by the landfill diversion target of the 1999 Landfill Directive that Slovakia has to meet in 2020 (a reduction in the biological municipal waste sent to landfill to 35 per cent of that generated in 1995).

Under the baseline scenario, the share of MBT is constant, while it is expected to increase under the full implementation scenario. Incineration shows a similar trend. The reason behind this is that, under full implementation, the requirement to reduce the amount of waste sent to landfill means that part of it is sent to MBT and incineration, following the same split of MBT and incineration as in 2015. This implies that new capacity is built. The corresponding results should therefore be interpreted in light of this modelling assumption.

Under both scenarios the amount of MSW separately collected for dry recycling and biowaste treatment increase. However, driven by the full implementation of the WFD, under the full implementation scenario the rate of growth is much higher. During 2020–2025 no more changes occur in the waste management shares in either scenario, and any changes after 2020 are only due to increasing amounts of generated waste.

Figure 84 Municipal solid waste destinations (first treatment), baseline scenario and



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

13.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 30 shows the modelled recycling rate according to the chosen method. Based on the assumptions made in the baseline scenario, under Method 4 Slovakia will achieve a recycling rate of 29 per cent by 2020 and remain there until 2025. In the baseline scenario, Slovakia is thus at risk of not meeting the target. This is, of course, a pessimistic view, and Slovakia might be expected to plan additional measures if it falls short of the 2020 target. However, such measures are not known and are thus not included in the baseline scenario.

Table 30 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	19	21	23	25	27	29	29	29	29	29	29

Table 31 compares model calculations and reported data. The recycling rate reported by Slovakia is very similar to the recycling rate calculated by the model.

Table 31 Comparison of modelled calculations and Slovakia's reported recycling rates according to the chosen method, 2015

Method 4	2015
Recycling rate calculated by the model (%)	19
Reported recycling rate (%)	20

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

13.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Slovakia moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

13.3.1 Environmental externalities and financial costs

Figure 85Figure gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Slovakia the costs related to the full implementation scenario are higher than those for the baseline scenario, and that the net costs are driven by the financial costs.

As Slovakia moves from the baseline scenario towards full implementation, the difference in costs increases significantly up to 2020. Thereafter, small changes occur because of the increase in generated waste.

Externalities are lower in the full implementation scenario, enabling environmental benefits to be realised when moving to full implementation.

Figure 85 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

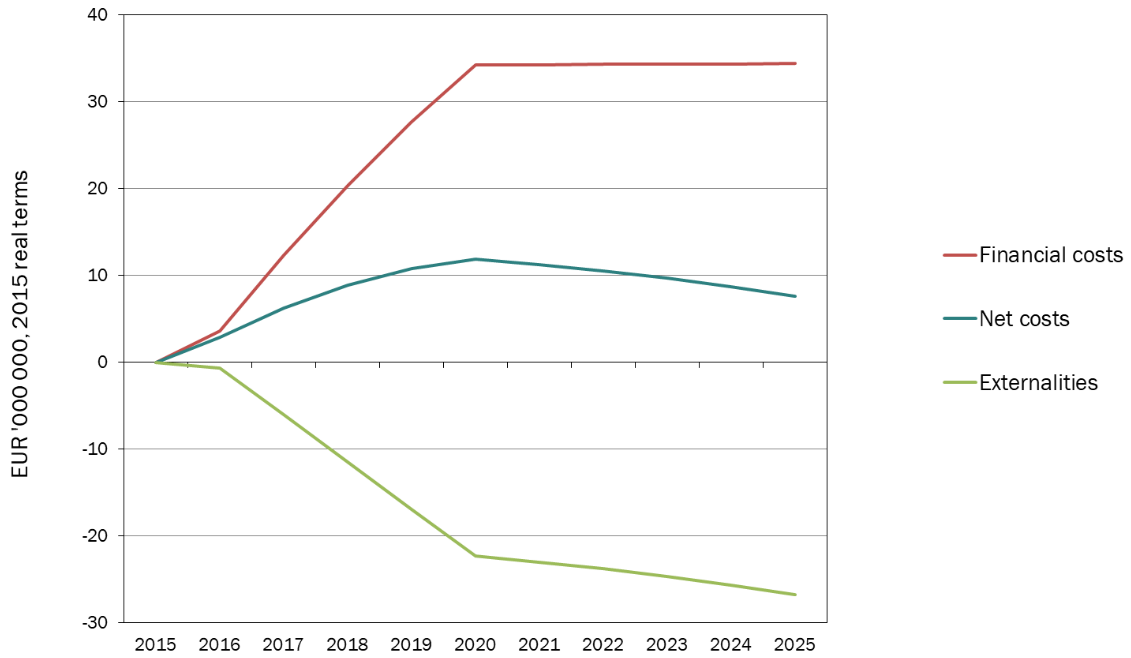
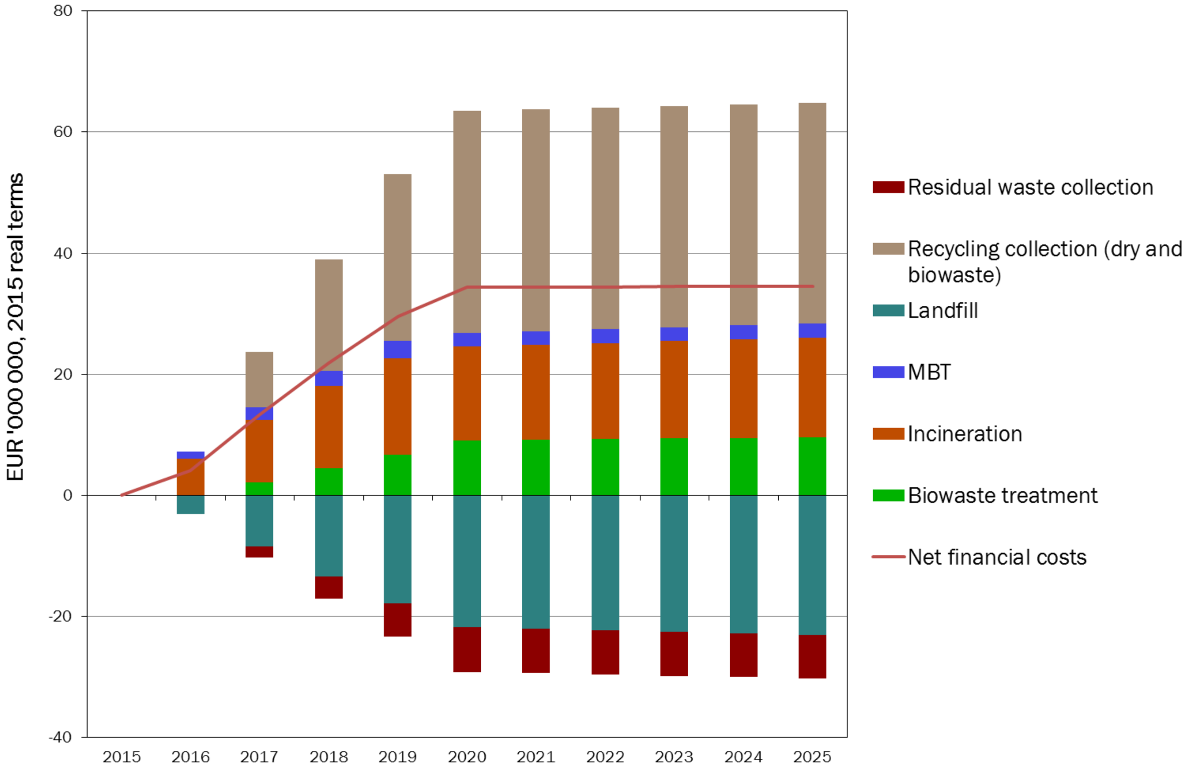


Figure 86Figure shows the split of costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The financial costs indicated in this graph (red line) are those shown in Figure 85.

To reach the EU Landfill Directive's diversion target, in the full implementation scenario the model assumes that a certain amount of waste is diverted from landfill to incineration and MBT. This results in higher incineration and MBT costs and lower landfill costs in the full implementation scenario; the major role in financial costs is however played by the higher costs related to recycling collection.

The difference in costs peaks in 2020 because the full implementation scenario assumes that the targets have to be met by then. Between 2020 and 2025 there are only marginal changes. The situation after 2020 is mainly influenced by the projected increase in the generation of MSW, and by the diversion target from landfill which is an absolute target. This means that, in 2025, the absolute amount that can be sent to landfill according to the Landfill Directive is the same as in 2020, but with increased waste generation, the landfill *share* is further reduced by 2025 under full implementation while no further improvement is assumed in the baseline scenario.

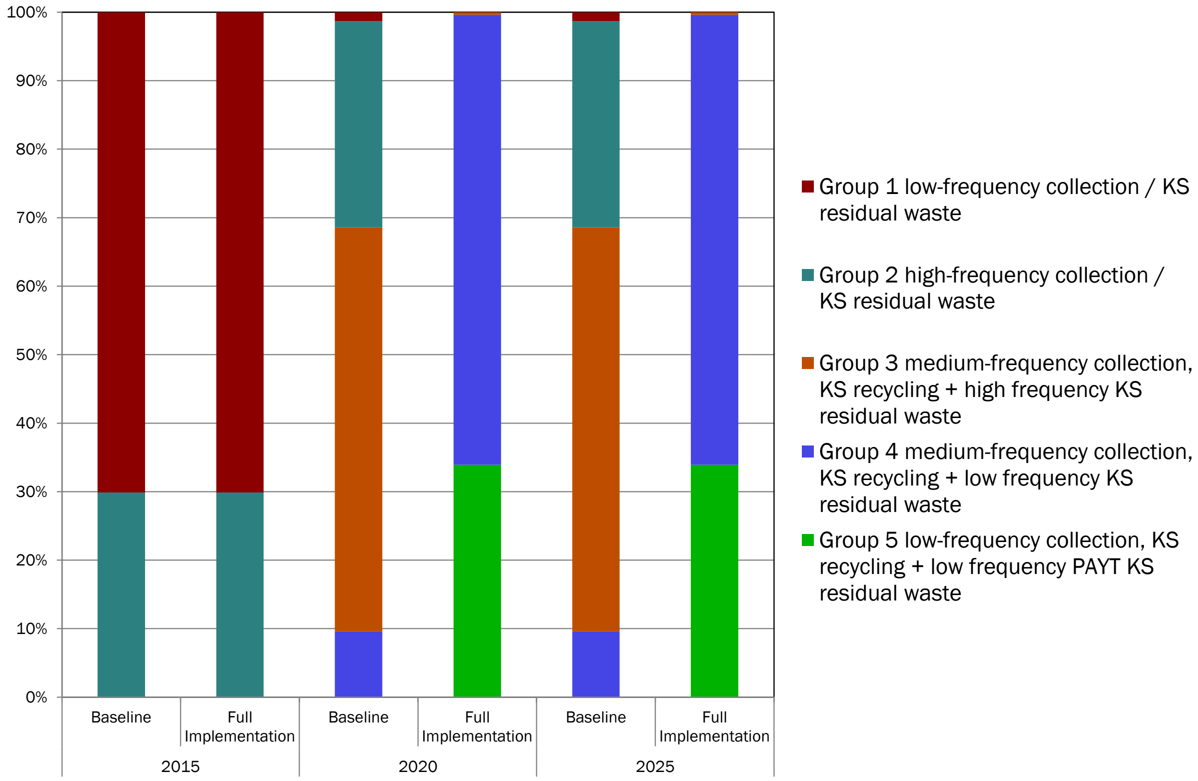
Figure 86 Financial costs of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



Box 13 Slovakia's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of residual waste collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Slovakia, given the difference in recycling rates between the two scenarios, full implementation implies a different configuration of the collection system. The model assumes that by 2020 under full implementation, nearly all households have moved from Groups 1 and 2 to Groups 4 and 5 with a very small amount of Group 3. After 2020 the full implementation scenario remains stable while the baseline scenario by 2025 is still predominantly Groups 2 and 3.

Figure 87 Assumed collection systems for the baseline and full implementation scenarios, 2015, 2020 and 2025, % of households



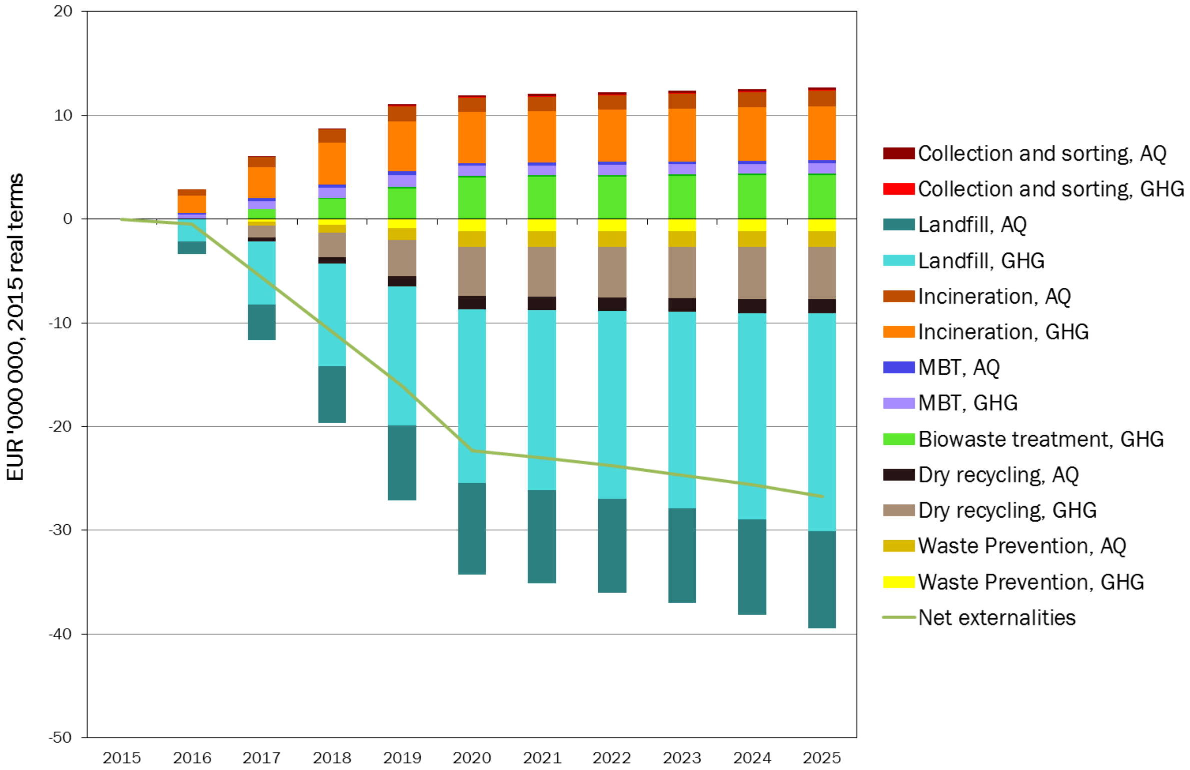
KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling.

Figure 88 shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as in Figure 86.

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHGs and other selected air pollutants from landfill and avoided emissions from dry recycling[20] in the full implementation scenario. There are, however, externalities caused by higher GHG emissions from biowaste treatment, incineration and MBT (direct process emissions) in the full implementation scenario.

The graph shows the maximum avoided externalities related to full implementation in comparison with the baseline in 2025. The significant difference is mainly due to impacts related to GHGs and other air pollutants from landfill. In the period 2020–2025, the difference in externalities from landfill grows at a lower rate because the difference in amounts sent to landfill stabilises. As mentioned above, after 2020 there is only a small growth because of the increase in total amounts of waste generated and the effect of the landfill diversion target.

Figure 88 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025



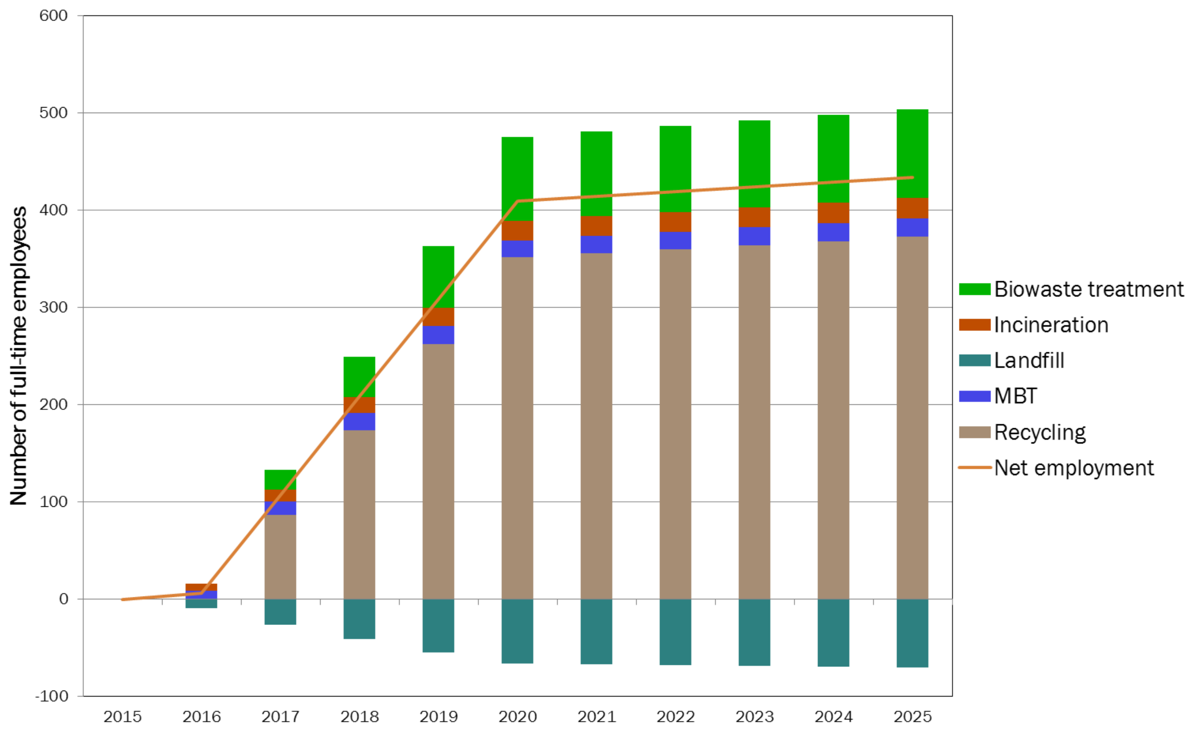
13.3.2 Employment

Figure 89 shows a net creation of additional jobs under the full implementation scenario. While some jobs are lost at landfill sites, more are created in recycling activities (collection and processing), biowaste treatment, incineration and MBT plants. The difference in employment between the two

[20] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

scenarios rises quickly in 2015–2020 and then stabilises. As before, the trend beyond 2020 is driven by the increase in total waste generation and its effect on landfill diversion targets.

Figure 89 Differences in number of full-time employees in the full implementation scenario compared to the baseline, 2015–2025

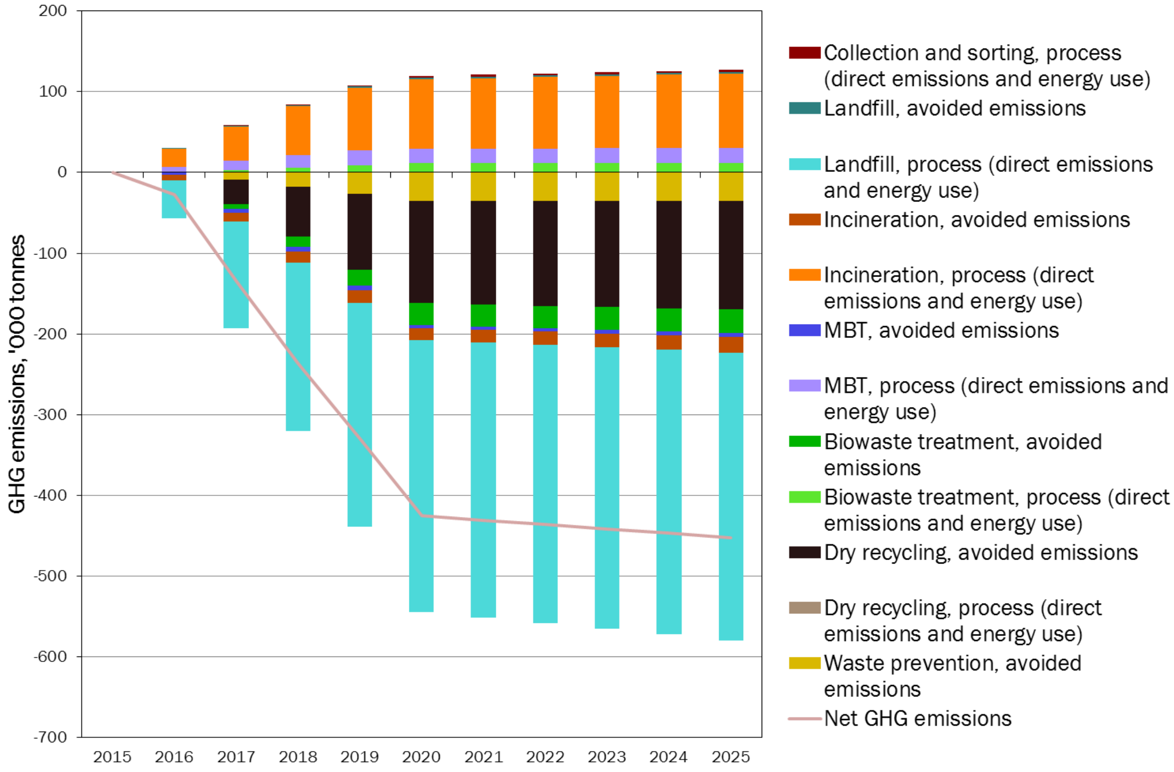


Note: Employment for residual waste collection is included in MBT, incineration and landfill, and employment for separate collection is included in recycling and biowaste treatment.

13.3.3 Greenhouse gas emissions

Figure 90 shows a significant decrease in net GHG emissions in the full implementation scenario compared to the baseline. The largest amounts of avoided GHGs result from less MSW being sent to landfill, followed by avoided emissions from dry recycling. Direct process emissions from MBT and incineration are higher in the full implementation scenario than in the baseline, but are outweighed by the emission savings through less landfill and more recycling.

Figure 90 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



13.3.4 Conclusion

Slovakia is at risk of missing the 2020 WFD recycling target, illustrated by a modelled recycling rate of 29 per cent in 2020 in the baseline scenario.

Overall, moving from the baseline to the full implementation scenario would increase the financial costs of MSW management in Slovakia up to 2020, but at the same time would substantially reduce externalities, especially GHG emissions from landfill. This would also create additional employment, mainly in recycling.

14 Spain

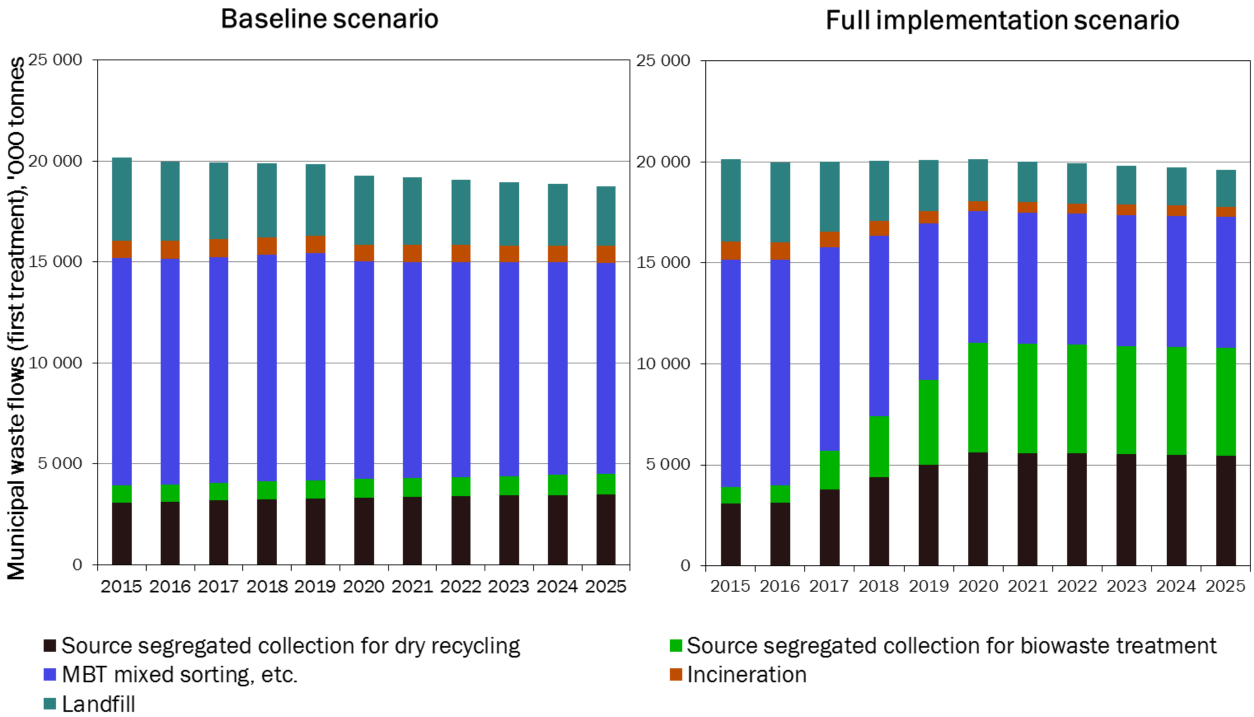
14.1 Development in the destinations of municipal solid waste

Figure 91 shows the direct inputs to different types of treatment for the baseline and full implementation scenarios.

The amount of MSW generated is projected to decrease in 2015–2025. In the full implementation scenario, it decreases less because the model assumes that the amount of garden waste requiring management increases when households are offered separate collection of biowaste/garden waste. Under both scenarios the amount of waste Spain sends to landfill will decrease, with a lower share in 2020 under the full implementation scenario. The share of incineration is small under both scenarios. The largest share is that of MBT, mixed sorting etc., which is constant under the baseline (by assumption), while it decreases under full implementation up to 2020 and then stays roughly constant thereafter. The shares of MSW separately collected for dry recycling and biowaste treatment increase significantly under full implementation.

Figure 91 shows that achieving the 2020 WFD 50 per cent recycling target implies that, under full implementation, collection for biowaste treatment and dry recycling increase at the expense of MBT and, to a lower extent, landfill.

Figure 91 Municipal solid waste destinations (first treatment), baseline scenario and full implementation scenario, 2015–2025



MBT: mechanical biological treatment

Note: The figures show the first treatment step only, i.e. incinerated waste does not include waste used as fuel after pre-treatment.

14.2 Distance to the 50 per cent recycling target of the Waste Framework Directive

Table 32 shows the modelled recycling rate for MSW according to the chosen method, which for Spain is Method 4. By default, the model does not take compost from MBT plants into account when calculating the recycling rate. However, Spain indicated that a part of the compost generated in MBT plants is counted in the recycling rate when reporting against the WFD's 50 per cent recycling target. However, no quantitative information is available about how much of the MBT-generated compost is taken into account. For the purpose of modelling, this share is therefore estimated based on data and information for 2014 as follows: Spain reported 2 894 000 tonnes of composted MSW to Eurostat, and indicated to the EEA that 792 000 tonnes of biowaste were separately collected and 11 647 000 tonnes of MSW were sent to MBT. Assuming that the difference between composted waste as reported to Eurostat and separately collected biowaste is compost from MBT that is classified as recycled in Spain, it is assumed that 18 per cent of the MBT input is turned into compost that is counted as recycled. This rate is then used for the modelling of the recycling rate for all years.

In the second row of Table 32, account is taken of 18 per cent of MBT input. Based on the assumptions made in the baseline scenario, under Method 4 Spain will achieve a recycling rate of 29 per cent accounting for MBT compost, and 20 per cent not accounting for MBT compost by 2020. By 2025 these rise to 31 per cent accounting for MBT compost, and 22 per cent not accounting for MBT compost. However, no information is available about how much of the MBT-derived compost actually meets the quality criteria for use on land, and therefore the calculated recycling rate including MBT compost might be overestimated.

Table 32 Calculated recycling rates according to the chosen method in the baseline scenario, 2015–2025

Method 4	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Recycling rate (%)	18	19	19	20	20	20	21	21	21	22	22
Recycling rate incl. 18 per cent share of MBT input (%)	27	27	28	28	29	29	29	30	30	30	31

Table 33 compares the recycling rate as calculated by the model, including some modifications to better reflect the way Spain reports against the WFD target. The first row is the recycling rate calculated for 2015 according to the chosen method. By default, the model subtracts rejects from the sorting of separately collected recyclables although Member States may report the separately collected amounts as recycled if the rejects are considered to be insignificant. The second row includes the rejects that the model accounts for when calculating losses from the recycling process. The third row accounts for 18 per cent of MBT inputs as compost. The fourth row, accounting for MBT inputs and including rejects, is the closest to the value reported by Spain in 2014. The differences in model results and the reported recycling rate may be explained in terms of both accounting for rejects and MBT derived compost in the calculations.

It should be remembered that the full implementation scenario is based on the assumption that Spain meets the 50 percent recycling target based on the default calculation in the model (i.e. subtracting rejects and not accounting for the MBT derived compost).

Table 33 Comparison of model calculations and Spain's reported recycling rates according to the chosen method, 2015

Method 4	2015
Recycling rate calculated by the model, default (%)	18
Recycling rate calculated by the model without subtracting rejects (%)	21
Recycling rate calculated by the model incl. 18 per cent share of MBT input (%)	27
Recycling rate calculated by the model incl. 18 per cent share of MBT input and without subtracting rejects (%)	30
Reported recycling rate (2014) (%)	31

Source of reported data: information made available by the European Commission and data supplied to Eurostat and submitted as part of Member State Waste Framework Directive Implementation Reports.

14.3 Impacts related to municipal solid waste management

The following graphs show the changes in impacts that would occur if Spain moves from the baseline to the full implementation scenario in the period 2015–2025 (full implementation scenario minus baseline scenario).

14.3.1 Environmental and financial costs

Figure 92 gives an overview of the changes in costs when moving from the baseline to the full implementation scenario. This overview is given for financial costs, externalities (monetised environmental costs for emissions of GHGs and selected air pollutants) and net costs (financial costs and externalities combined). If net costs are negative, they represent a benefit.

The graph shows that for Spain the costs related to full implementation are higher than those for the baseline scenario, and that the net costs are mainly driven by the financial costs.

As Spain moves from the baseline towards full implementation, the difference in costs increases up to 2020. The difference decreases slowly thereafter, due to a small difference in generated amounts of waste.

Externalities in the full implementation scenario are lower than in the baseline, showing that environmental benefits arise when moving away from the baseline to a full implementation scenario.

Figure 92 Externalities, financial costs and net costs of the full implementation scenario compared to the baseline, 2015–2025

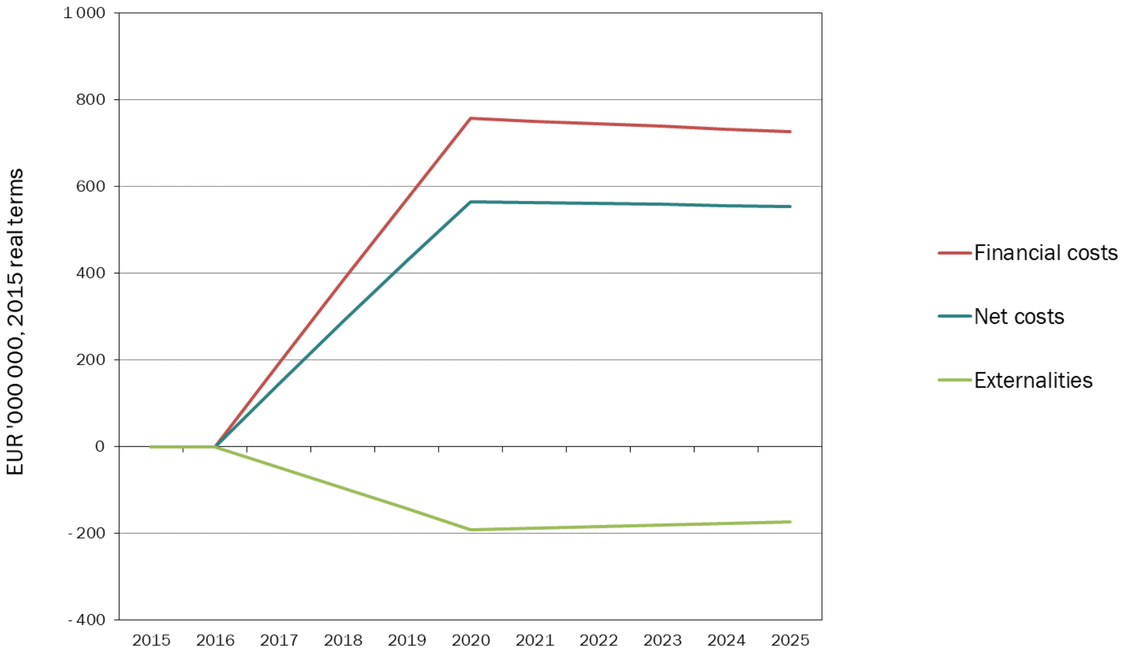
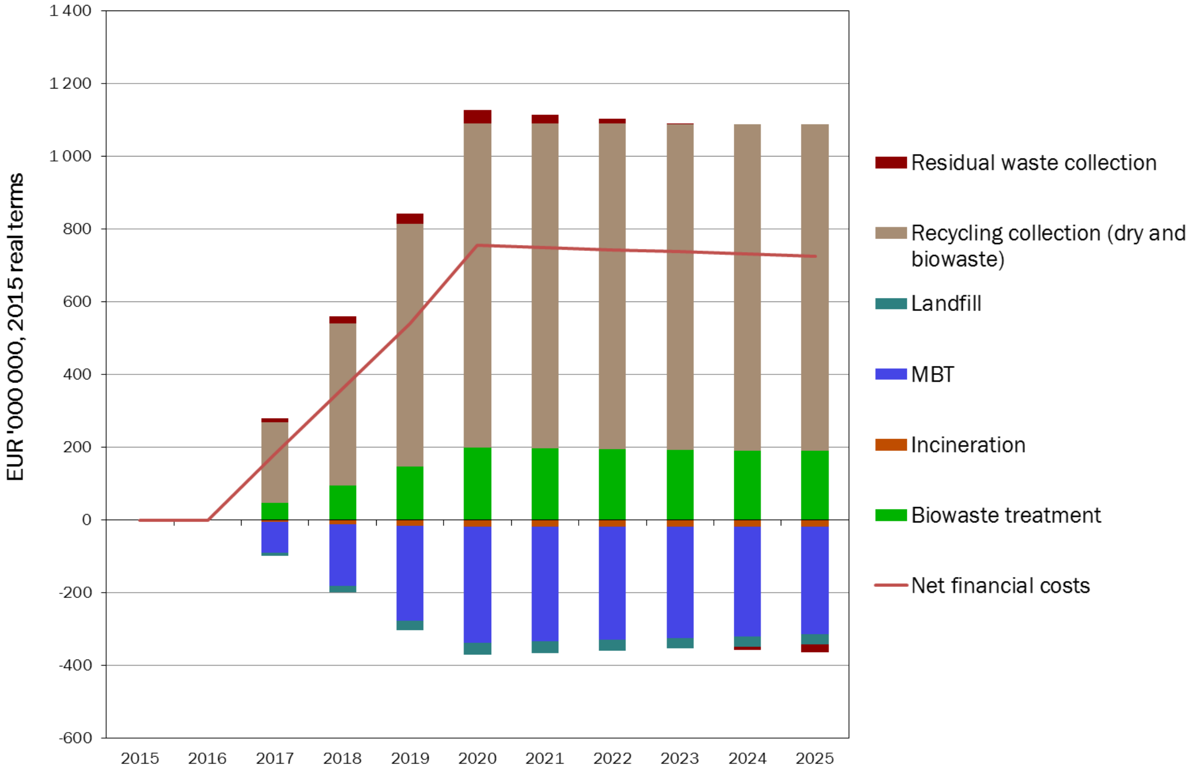


Figure 93 shows the split of costs related to the collection and treatment of MSW under the full implementation scenario compared to the baseline. The net costs indicated in this graph (red line) are those shown in Figure 92.

In the full implementation scenario, the share of waste collected separately for recycling and biowaste treatment increases while waste sent to landfill, MBT and incineration all decrease, as compared to the baseline. This results, under full implementation, in lower costs for MBT, incineration and landfill, implying at the same time higher costs from the larger biowaste treatment and recycling shares. The net impact is an increase in financial costs.

Collection costs for recycling increase because the increase in the recycling rate to 50 per cent in the full implementation scenario requires the introduction of more complex and more costly collection systems (Box 14).

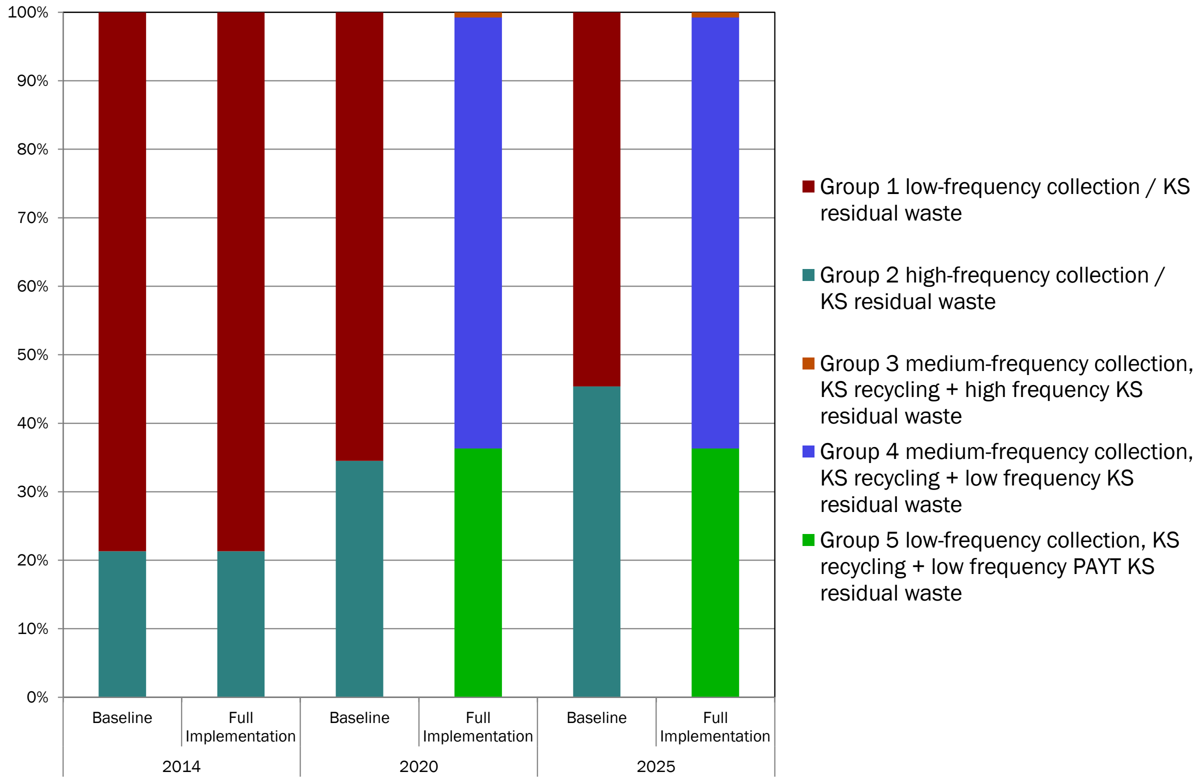
Figure 93 Financial costs of waste collection and treatment in the full implementation



Box 14 Spain's collection systems

The model assumes different types of collection services. A distinction is made between five different types, ranging from basic low-performing systems (Group 1), to advanced high-recycling ones (Group 5). The more advanced systems tend to imply higher costs for recycling collection and lower costs for collection of residual waste, except when moving from Group 1 to Group 2. However, there is no linear development. In general, the higher groups move towards greater frequency and density of recycling collection and lower frequency of residual waste collection. Another feature differentiating the systems is related to the density and quality of civic amenity sites. For Spain, recycling rates differ between the baseline and the full implementation scenarios, and the share of MBT differs as well. This implies, under full implementation, a significant restructuring of collection systems from Groups 1 and 2 to Groups 4 and 5, towards systems where kerbside recycling is present. The model also assumes that in order to reach 50 per cent recycling with Method 4, PAYT-based systems have to be introduced. In the baseline, on the other hand, the structure is similar over time, with an increasing share of Group 2 over Group 1 between 2014 and 2025.

Figure 94 Assumed collection systems for the baseline and the full implementation scenarios, 2014, 2020 and 2025, % of households



KS: kerbside collection
PAYT: pay as you throw
Note: More details about the modelling of waste collection can be found in the model documentation: [Eunomia, 2016, Support to the waste targets review, technical guidance on collections modelling].

shows externalities related to the collection and treatment of MSW when moving from the baseline scenario to full implementation. The externalities indicated in this graph (green line) are the same as those shown in Figure 92

The graph shows a net avoidance of externalities in the full implementation scenario compared to the baseline. This result is mainly driven by reduced GHG emissions from dry recycling, MBT and landfill. The waste prevention effect is due to the assumption in the model that the introduction of separate collection of food waste raises citizens' awareness. These improvements are only partially counteracted by higher externalities from GHG emissions due to the increase in biowaste treatment. Overall, externalities are lower under full implementation.
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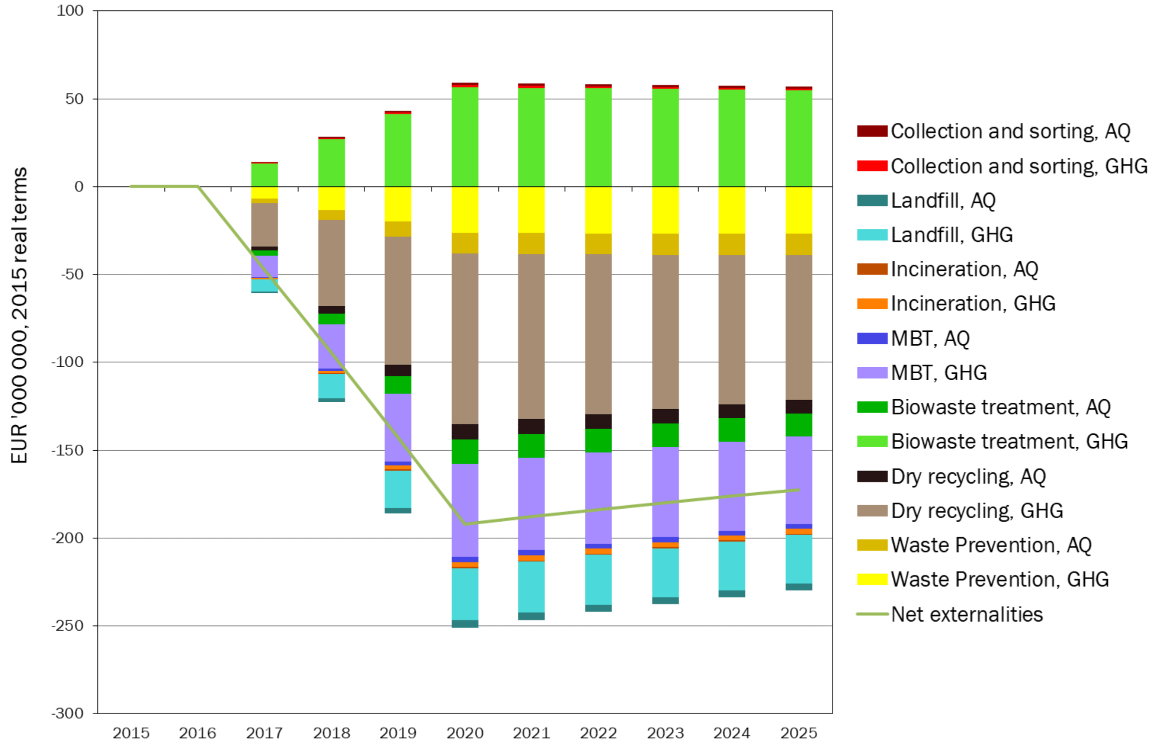
Figure 95 Differences in the externalities of waste collection and treatment in the full implementation scenario relative to the baseline, 2015–2025

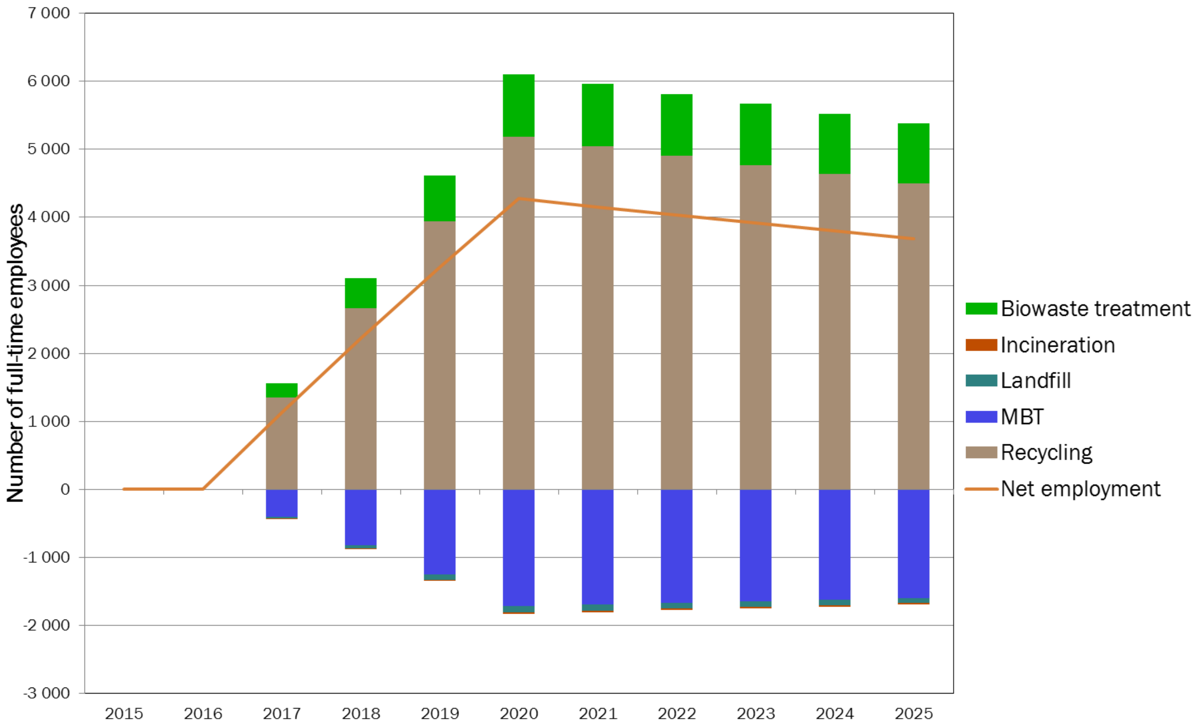


[21] More recycling always results in fewer GHG emissions because the recycled materials replace virgin materials in production processes, avoiding the GHG emissions that would have been emitted had virgin materials been used.

14.3.2 Employment

Figure 96 shows the net creation of additional employment under the full implementation scenario. Some jobs are lost due to significant reductions in the MBT share, but more are created in recycling and biowaste treatment.

Figure 96 Differences in the number of full-time employees in the full implementation scenario compared to the baseline, 2015–2025

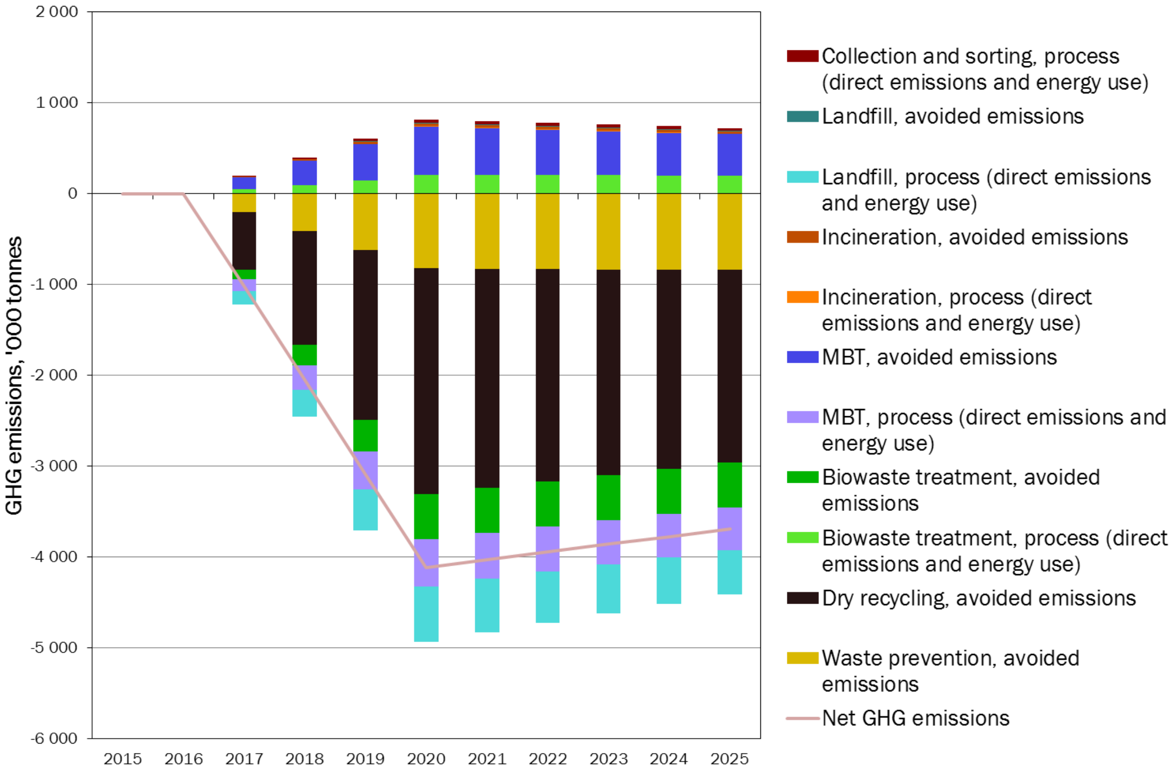


Note: Employment for residual waste collection is included in MBT, and employment for separate collection is included in recycling and biowaste treatment.

14.3.3 Greenhouse gas emissions

Figure 97Figure shows a significant decrease in GHG emissions in the full implementation scenario compared to the baseline. The largest reductions in GHG emissions result from avoided emissions due to dry recycling and waste prevention. Avoided emissions due to biowaste treatment and reductions in direct emissions from MBT and landfill also play a role. This improvement is only partially counteracted by the decrease in avoided GHG emissions due to the decrease in MBT, and by the increase in direct emissions from biowaste treatment.

Figure 97 Differences in greenhouse gas emissions in the full implementation scenario relative to the baseline, 2015–2025



Note: Greenhouse gas emissions include emissions of carbon dioxide, methane and nitrous oxide (Model documentation, environmental modelling, Eunomia 2014).

14.3.4 Conclusion

Spain is at risk of missing the 2020 WFD recycling target: the modelled baseline scenario recycling rate indicates 20 per cent in 2020, or 29 per cent when a share of MBT input is included.

Comparing the baseline scenario with the full implementation scenario, Spain has to further increase collection for dry recycling and biowaste treatment, significantly reducing the role of MBT, to meet the 2020 target. Also, a significant restructuring of the collection systems is suggested by the full implementation scenario.

The full implementation scenario, as compared to the baseline, is expected to bring reduced externalities, as well as increased employment, mainly in the recycling sector. At the same time, the financial costs are larger under this scenario. However, it has to be kept in mind that the full implementation scenario does not currently take account of compost derived from treatment of mixed municipal waste in MBT plants and subtracts rejects from separately collected recyclables. The overall differences between the baseline and full implementation scenarios in terms of costs, GHG emissions and employment would be smaller if the full implementation scenario were to take these into account.