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GREENHOUSE GAS EMISSION REDUCTION DUE TO IMPROVEMENT OF BIODEGRADABLE WASTE MANAGEMENT SYSTEM

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To reduce emissions of greenhouse gas (GHG) from landfills, the European Union (EU) Landfill Directive 1999/31/EC requires that there be a progressive decrease in the municipal biodegradable waste disposal. The main problem of waste management (WM) in Latvia is its heavy dependence on the waste disposal at landfills. The poorly developed system for the sorted municipal waste collection and the promotion of landfilling as a major treatment option led to the disposal of 84% of the total collected municipal waste in 2012, with a high biodegradable fraction. In Latvia, the volume of emissions due to activities of the WM branch was 5.23% (632.6 CO_2 eq.) of the total GHG emissions produced in the National economy in 2010 (12 097 Gg CO_2 eq., except the land use, land-use change and forestry). Having revised the current situation in the management of biodegradable waste in Latvia, the authors propose improvements in this area. In the work, analysis of environmental impact was carried out using Waste Management Planning System (WAMPS) software in the WM modelling scenarios. The software computes the emissions, energy and turnover of waste streams for the processes within the WM system such as waste collection and transportation, composting, anaerobic digestion, and the final disposal (landfilling or incineration). The results of WAMPS modelling are presented in four categories associated with the environmental impact: acidification, global warming, eutrophication and photo-oxidant formation, each characterised by a particular emission. These categories cover an integrated WM system, starting with the point when products turn to waste which is then thrown into the bin for waste at its generation source, and ending with the point where the waste transforms either into useful material (recycled material, biogas or compost) or contributes to emissions into environment after the final disposal at a landfill or an incineration plant.

Keywords: *biodegradable waste, mathematical modelling, waste management*

1. INTRODUCTION

The aim of this work is to find the ways of how to improve the waste management (WM) system in Latvia in order to reduce disposal of biodegradable waste and generation of the greenhouse gases (GHG) at landfills.

One of the main problems to be indicated is that of strong dependence of the Latvian system for solid WM on using landfills, which, in turn, entails a number of other problems: a large amount of disposed waste; not fulfilled targets as to decreasing the disposal of biodegradable waste; as yet, a high proportion of biodegradable waste in the total disposed municipal waste; and a low proportion of the recycled household waste [1]. Also, the non-optimal organisation and performance of the mentioned system has given rise to unjustifiably large amounts of GHG emissions, and, consequently, to global environmental impact [2, 3].

The data for the total yearly produced bio-waste amount in the European Union (EU) countries (as of 2010) are the following: 118-138 Mt, of which ~ 88 Mt originate from municipal waste, and 30-50 Mt – from industrial sources (e.g. food processing); still, in that year on the average 40% of EU produced bio-waste was landfilled, and up to 100% – in some of the member states [4, 5]. The structure of waste material deposited at the landfills in Latvia is estimated in the research project "*The Assessments of Dissolved Organic Carbon Parameters in the Landfill Waste Material"* (2011). The researchers obtained the following estimates for the disposed waste content: bio-waste – 50.3% - 51.7%; plastic – 10.3% - 11.8%; paper/cardboard – 5.7% - 8%, glass – 10.9% -19 %; textile, rubber and leather – 3% - 8.6 %; and metal – 2% - 4.6% [6].

The European Commission (EC) investigation [4] shows that the main food waste producers are households (42%) and the food manufacturing industry (39%), whereas as the third bigger producer (14%) the food service & catering sector is named. According to the European Waste Codes (EWC) the main municipal biodegradable waste streams are classified as follows:

Kitchen and canteen waste (food waste) (20 01 08 EWC code);

Garden and park waste (20 02 01 EWC code);

Mixed municipal waste (20 03 01 EWC code);

Waste from public market (20 03 02 EWC code) including biodegradable materials' equivalents (codes 20 01 08 EWC and 20 02 01 EWC).

2. STATISTICAL DATA ON THE MAIN MUNICIPAL BIODEGRADABLE WASTE STREAMS

Officially obtained statistical data on the main municipal streams of biodegradable waste mentioned before and its collection in Latvia are given in Table 1 [7]. The tabulated data show a significant discrepancy in different waste streams and treatment methods. Most probably, interpretation of statistical data is based on the reports provided by facilities and institutions while not including the waste produced by households. In the official reports the food waste (20 01 08 EWC code) management is not stated as obligatory for the practice, and a legal possibility to interpret waste codes allows treating food waste as a mixed municipal one. Nevertheless, owing to significant improvements made in green waste (20 02 01 EWC code) management (in particular, its total recycled amount grew to 48 808 tonnes in 2013), as the main treatment method the open windrow composting is used. The majority of mixed municipal waste (20 03 01 EWC code) is mechanically pre-treated at landfills. As could be understood from statistical reports, since 2009 in line with Regulation (EU) № 142/2011 on the animal by-products (instead of Regulation (EC) №1069/2009), the produced food waste stream is considered as municipal (Table 1).

Table 1

Main municipal bio-waste streams (tonnes) and their treatment in Latvia (2005 -2013)

	Food waste (20 01 08 EWC code)				Garden and park waste (20 02 01 EWC code)			
	Produced	Collected	Recycled	Landfilled	Produced	Collected	Recycled	Landfilled
2005	28	-	-	85	-	-	-	12 604
2006	91	50	-	50	-	13 010	4131	17 695
2007	93	94	-	94	1926	14 666	7 562	7 446
2008	38	50	-	50	935	15 526	7 763	7 544
2009	33	11	-	11	1 156	5 127	3 169	11 654
2010	44	-	-	-	996	5 348	4 139	8 257
2011	32	888	-	-	4 126	20 818	10 508	1 799
2012	5 090	36	10	-	2 381	35 857	13 180	1 320
2013	54	33	11	-	27 818	29 874	48 808	1 702

	Mixed municipal waste (20 03 01 EWC code)				Waste from public market (20 03 02 EWC code)			
	Produced	Collected	Recycled	Landfilled	Produced	Collected	Recycled	Landfilled
2005	539 614	-	3 246	539 614	363	-	-	363
2006	138 563	884 691	99 752	586 829	-	546	-	376
2007	160 891	745 787	42 015	710 997	-	235	-	297
2008	152 254	670 448	39 698	627 142	-	600	-	2
2009	148 602	533 865	5	594 217	-	647	-	-
2010	138 173	512 987	5	568 517	-	654	-	-
2011	162 675	412 157	10 828	509 751	-	593	-	-
2012	108 340	495 959	35 388	502 206	-	-	-	-
2013	100 899	510 109	56 469	503 733	-	-	-	-

3. BIO-WASTE TREATMENT OPTIONS

In order to elaborate the National Waste Management (WM) system for the first WM planning stage (2006-2012), the Latvian territory was divided into ten WM planning regions. In each of them one landfill for solid waste disposal was organised in compliance with the EU sanitary requirements. Mainly this was dictated by low cost of the final solid waste disposal (as compared with waste incineration) due to a low inhabitant density in the territory. Besides, landfilling allows for disposal of all materials in a solid waste stream for any WM system and technology process [8, 9].

The data presented in Table 2 show the WM performance for each municipal waste planning (MWP) region. Overall, 583 069 tonnes of municipal waste were collected in 2013; exclusions from this total are: waste from septic-class tank sludge (20 03 04 EWC code), waste from sewage cleaning (20 03 06 EWC code), and bulky waste (20 03 07 EWC code). As concerns the metal waste (20 01 40 EWC code) fraction, it is corrected for the amount not related to the produced household waste.

According to the statistical data, a large discrepancy is observed between the collected and the disposed waste amounts within regions, which indicates that the industrial waste is treated as municipal; also, the recycled amount of waste varies widely for different regions. As shown in Table 2, in 2013 the collected mixed municipal waste (MW) was 219 kg capita^{-1}; recycled – 30 kg capita^{-1}, and landfilled – 185 kg capita^{-1}.

Table 2

Municipal waste treatment by MWP regions in 2013

MWP region	Population	Collected mixed MW	kg capita^{-1}	Recycled	kg capita^{-1}	Landfilled	kg capita^{-1}
Austrumlatgale	94 257	3 419	36	400	4	16 792	178
Dienvidlatgale	179 336	47 789	266	470	3	52 830	295
Liepāja	147 274	38 522	262	558	4	31 743	216
Maliena	70 349	5 737	82	1 529	22	7 715	110
Piejūra	138 959	62 725	451	4 429	32	28 821	207
Pierīga	883 228	249 799	283	35 664	40	300 266	340
Ventspils	75 421	19 393	257	733	10	7 255	96
Vidusdaugava	114 723	14 588	127	584	5	18 418	161
Zemgale	161 784	38 313	237	2 405	15	27 735	171
Ziemeļvidzeme	158 494	29 823	188	26 190	165	12 158	77
Total / average	2 023 825	510 106	219	72 962	30	503 733	185

Kļavenieks reports [10] that today less than half of disposed mixed waste could be pre-treated before landfilling (see Table 3). The planned waste pre-treatment capacity in Latvia, after establishment of a new infrastructure, will reach 701 380 tonnes per year in 2016. Landfilling of mixed MW without pre-treatment or separation of the biological fraction is common practice in Latvia. Nowadays, this option is reasonably considered as a bad practice, since it is associated with environmental and safety risks caused by landfill gas collection [11] with potential GHG (in our case methane) generation, treatment of leachates as well as worthless land usage. Also, problems might arise with further application of such a material after its pre-treatment at landfills (see Fig. 1).

The results of mechanical sorting of mixed waste show that the coarse fraction mostly complies with the standard for Refuse Derived Fuel (RDF). However, the content of moisture in all fractions is too high for RDF production; the separated organic fraction gives much pollution and cannot be used as compost [12]. Therefore, the separation of kitchen and garden waste at source must be a high-priority issue in municipal waste management.

The total capacity of compost plants at landfills is 29 720 m^2 (see Table 3). These plants are designed for composting the pre-treated fine fraction. Currently, a number of municipalities have their own green waste repositories where green waste is stored, managed and used for landscaping, but this amount is not mentioned in the public statistics reports.

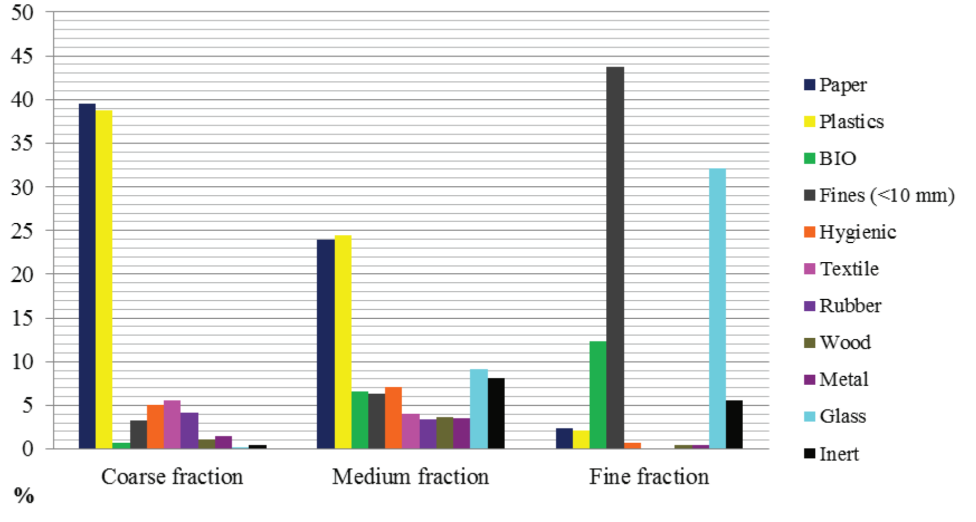


Fig. 1. The average composition of waste fractions after waste pre-treatment by a disc screener (%, for dry waste)

The Latvian Biogas Association points out that 54 biogas plants are working in Latvia in 2014 with the total installed capacity of ~150 million m^3, including three biogas plants at landfills (Daibe, Ķīvītes and Getliņi); one biogas plant for treatment of urban sewage sludge; two biogas plants of food industry (biogas is used directly in the combustion boiler); one wood biomass gasification facility, and 48 biogas plants in agricultural sector [13]. This allows production of 330 GWh electricity, which suffices for heating 140 000 households.

Table 3

Mixed waste pre-treatment capacity in Latvia (tonnes and m²)

WMPR / Operator	Location of mechanical pre-treatment infrastructure	Capacity, tonnes	Year *of opening?*	Area covered by compost plant, m^2
Ziemeļvidzeme / ZAAO	Daibe, landfill	30 000	2011	5 632
Vidusdaugava / Vidusdaugavas SPAAO	Dziļā vāda, landfill	80 000	2012	14 000
Liepāja / VAAO	Vibsteri, waste operator	40 000	2012	
Pierīga / Ķilupe	Ķilupe, waste operator	14 000	2012	
Zemgale / Jelgavas komunālie pakalpojumi	Brakšķi, landfill	30 000	2013	
Ventspils / Ventspils labiekārtošanas kombināts	Pentuļi, landfill	22 380	2013	
Dienvidlatgale / AADSO	Cinīši, landfill	60 000	2015	1 050
Piejūra / AAS Piejūra	Janvāri, landfill	40 000	2015	5 038
Austrumlatgale / ALAAS	Križevņiki, landfill	20 000	2015	2 000
Piejūra / AAS Piejūra	Jūrmala, waste operator	20 000	2015	
Alba 5 (AP Kaudzītes)	Kaudzītes, landfill	15 000	2015	2 000
Pierīga / Vides pakalpojumu grupa/Getliņi EKO	Getliņi, landfill	300 000	2016	
Liepāja / EKO Kurzeme/ Liepājas RAS	Ķīvītes, landfill	30 000	2016	
Total mixed waste pre-treatment capacity: 1) in January, 2014 - 216 380 tonnes $year^{-1}$; 2) in January , 2016 -701 380 tonnes $year^{-1}$ Total area covered by compost plants: 29 720 m^2.				

4. MATERIALS AND METHODS

In the analysis of the environmental impact due to activities of WM branch the Waste Management Planning System (WAMPS) software was used for modelling the relevant scenarios. The new version of WAMPS (see Fig. 2) allows the user to create more scenarios for WM development, since it has been complemented with a mechanical pre-treatment process in which new fractions (metal, fine fraction and

RDF) are produced. The new waste material technology – incineration in the cement kiln – is also one of the solutions allowing the use of waste as burning material that would partly replace fossil resources.

The WAMPS software calculates emissions, energy and turnover of waste streams for processes within the WM system, e.g., waste collection and transportation, composting, anaerobic digestion, and final disposal – landfilling or incineration [14].

The software is based on the Life Cycle Assessment (LCA) approach, and the results of modelling are presented in four environmental impact categories: acidification, global warming, eutrophication and photo-oxidant formation, each characterised by a particular emission. This paper focuses only on the global warming category.

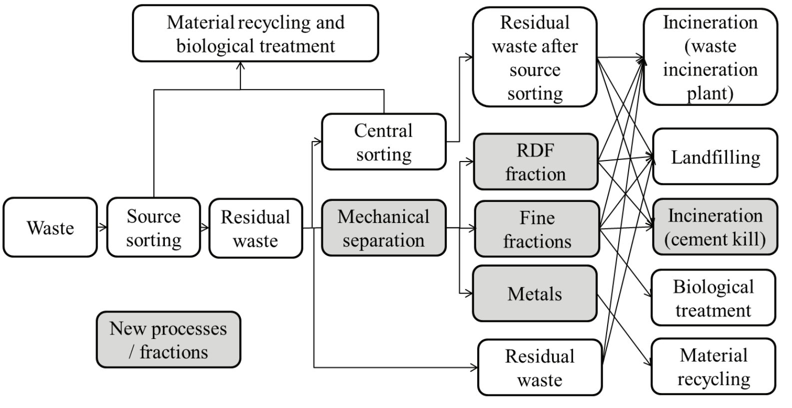


Fig. 2. Overview of WAMPS modelling possibilities

The WAMPS covers an integrated WM system – starting with the activities where products become waste and put into the waste bin at its generation source – to the last point where the waste transforms either to useful material (recycled material, biogas or compost) or contributes to emissions into the environment after its final disposal at a landfill or an incineration plant. The computation can give also negative net emissions: for example, a WM system with incineration could give lower emissions than the corresponding energy production in the background system (based on fossil fuels). The net emissions in each of the WM scenarios are calculated by the following equation [15]:

$$E_{net} = E_{waste} - E_{background} \quad (1)$$

where E_{net} – the net emissions (tonnes year^{-1});

E_{waste} – emissions caused by the WM processes during which a definite amount of products (tonnes/year) or energy are obtained;

$E_{background}$ – emissions from the same volume of alternative virgin production in the background system (tonnes year^{-1}).

In the development of WAMPS software a number of limitations were revealed and eliminated.

4.1. Waste amount and composition

For the modelling purpose, it is assumed that the total collected amount of municipal waste corresponds to the produced amount listed in the publicly available No. 3-Waste Report on municipal WM, i.e. 583 068 tonnes year^{-1} (see Table 4). Amount of such waste from the institutions and small enterprises (185 624 tonnes year^{-1}) is shown in the Produced Waste section of statistical data [7]. According to the Eurostat report [16], 64% of the total Latvian population are living in the apartment buildings, which implies the following shares for the rest of total collected municipal waste: 64% (or 254 364 tonnes year^{-1}) from multi-storey buildings and 36% (or 143 080 tonnes year^{-1}) from private houses.

Table 4

Municipal waste composition (tonnes year^{-1} and % by weight)

	Institutions and small enterprises	Multi-storey buildings	Private houses
Waste amount, tonnes	185 624	254 364	143 080
Waste fraction, % by weight			
Paper and cardboard	32%	10%	11%
Newspaper, magazines, etc.	7%	3%	3%
Plastic	27%	28%	21%
Metal packaging (aluminium and steel)	1%	2%	2%
Glass	4%	8%	8%
Rubber, incl. tyres	-	-	-
Clothes, shoes, textiles and leather	-	-	-
Wood	-	-	-
Biodegradable material (mixed	-	13%	1%
Organic degradable kitchen waste	10%	29%	19%
Garden Waste	14%	-	20%
Hazardous waste	1%	2%	-
Electric and electronic wastes (WEEE)	-	-	3%
Inert wastes	3%	5%	4%
Non-hazardous batteries	-	-	5%
Steel and metal scrap (mixed)	-	-	-
Others	1%	-	3%
Total	100%	100%	100%

It is assumed that the municipal waste composition in the country corresponds to that estimated for the Ogre municipality (39 233 inhabitants). In Table 4, the composition of the sorted and measured waste amount (28 tonnes) is given for the summer season [17].

According to the survey for the Marupe municipality – a Riga's suburb with 10 000 inhabitants of whom 5 000 live in private houses – in 2014 two thirds of 171 respondents confirm that they have already organised the green waste backyard composting. This is taken into account in view of the task to realise the target of Landfill Directive and meet its requirements on biodegradable waste. According to the worked out scenarios, all private householders are to reduce the green waste amount at source gradually: 50% of weight in Scenario 1 and up to 100% - in Scenarios 2 and 3 by home composting.

Having estimated the statistical data and waste composition, the institutions are able to fulfil green waste treatment targets already now by 100 % separation of the produced green waste. The treatment can be done using open windrow composting.

As mentioned above, the third largest producer of food waste is the food service and catering sector. This sector is accounted for in Scenario 2, while householders living in multi-storey buildings are added to Scenario 3.

Currently, the Waste Framework Directive objectives are rather ambitious for Latvia, so now a less ambitious goal is chosen, i.e. 25% source sorting of the waste materials: paper / cardboard, glass, plastic and metal in Scenarios 1 - 3 (see Table 5 and Fig. 3).

Table 5

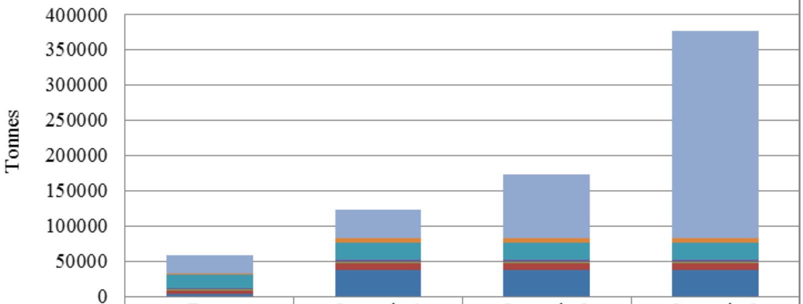
Waste sorting at source in the studied waste management scenarios (%, tonnes)

Scenario	Paper / card -board	Glass	Plastic	Metal	Food waste		Green waste	
					Institutions	Multi-storey buildings	Institutions	Private houses
Base	18%	13%	7 %	15%	<1%		100%	-
Scenario 1	25%	25%	25%	25%	-	-	100%	50%
Scenario 2	25%	25%	25%	25%	100%	-	100%	100%
Scenario 3	25%	25%	25%	25%	100%	100%	100%	100%

After the source sorting of waste material (paper, plastics, glass, metallic packages and bio-waste), the rest of waste (mixed) is transported to a landfill equipped with a mechanical sorting line for pre-treatment. According to the results of investigation [12], the following four fractions are separated from the total mixed household waste mass:

~35 % – fine fraction mainly composed of organic waste;
~40 % – medium fraction of diversified waste;
~22 % – coarse fraction (RDF) containing waste of high calorific value (plastics, paper, textile, rubber);
~3 % – iron-containing fraction.

This percentage was used in mechanical sorting calculations in the considered WM scenarios.



	Base	Scenario 1	Scenario 2	Scenario 3
Organic degradable waste	26043	40295	89628	293398
Newspapers, magazines etc	1646	6229	6229	6229
Paper packages	19116	25501	25501	25501
Aluminium packages	1215	1987	1987	1987
Steel packages and steel scrap	1856	1485	1485	1485
Glass	5407	9805	9805	9805
Plastic packages	3533	38205	38205	38205

Fig.3. Projection of waste recycling (tonnes) in the studied waste management scenarios

4.2. Waste management scenarios and technologies

For the Latvian WM system a base scenario and three alternative scenarios have been developed (Table 6). The scenarios are hypothetical, and characterise possible trends in the development of food waste and green waste management in Latvia towards reducing GHG emissions. The base scenario relates to the situation existing in the country.

The assumptions made in the mathematical design of the models are (see Table 6 and Fig. 4):

1. the biodegradable waste composting produces compost that is 60% of the total mass and is used as fertiliser for landscaping, agricultural or local consumption at home;
2. in all scenarios the energy produced from landfill gas and waste incineration replaces fossil fuel in a background system (i.e. natural gas);
3. in all scenarios the landfill gas is recovered and combusted with 35% efficiency [11,12,16,18], i.e. providing 50% of district heating and 40% of electricity;
4. the energy recovery from incineration process is 20% of electricity and 80 % of district heating; incineration process complies with EU requirements.

Table 6

Main characteristics of studied waste management scenarios

<table>
<tr><th rowspan="2">Scenario</th><th rowspan="2">Mechanical sorting</th><th colspan="3">Biodegradable organic waste (after source sorting)</th><th rowspan="2">Fine fraction (after mechanical sorting). Composted and used as covering material for disposal site</th><th colspan="3">RDF fraction (after mechanical sorting)</th><th rowspan="2">Rest waste. Landfill</th></tr>
<tr><th>Home composting</th><th>Open windrow composting</th><th>Anaerobic digestion</th><th>Landfill</th><th>Incineration (WfE)</th><th>Incineration (Cement kiln)</th></tr>
<tr><td>Base</td><td>+</td><td>-</td><td>100%</td><td>-</td><td>100%</td><td>100%</td><td>-</td><td>-</td><td>100%</td></tr>
<tr><td rowspan="2">Scenario 1</td><td rowspan="2">+</td><td colspan="2">100%</td><td>-</td><td rowspan="2">100%</td><td rowspan="2">80%</td><td rowspan="2">10%</td><td rowspan="2">10%</td><td rowspan="2">100%</td></tr>
<tr><td>35%</td><td>65%</td><td>-</td></tr>
<tr><td rowspan="2">Scenario 2</td><td rowspan="2">+</td><td colspan="2">75%</td><td>25%</td><td rowspan="2">100%</td><td rowspan="2">80%</td><td rowspan="2">10%</td><td rowspan="2">10%</td><td rowspan="2">100%</td></tr>
<tr><td>52%</td><td>48%</td><td>100%</td></tr>
<tr><td rowspan="2">Scenario 3</td><td rowspan="2">+</td><td colspan="2">30%</td><td>70%</td><td rowspan="2">100%</td><td rowspan="2">80%</td><td rowspan="2">10%</td><td rowspan="2">10%</td><td rowspan="2">100%</td></tr>
<tr><td>53%</td><td>47 %</td><td>100%</td></tr>
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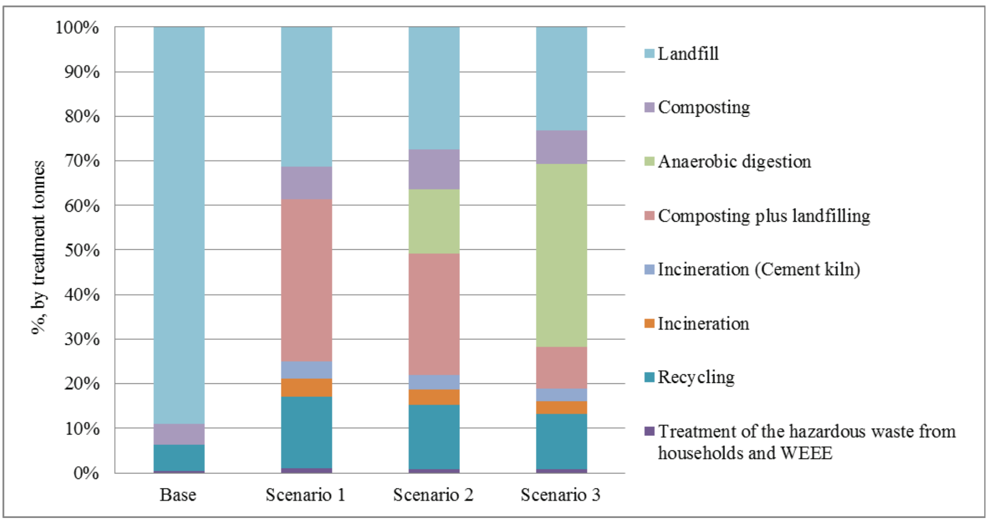

Fig.4. Projection of treatment for studied waste management scenarios (% by weight)

5. RESULTS

The results of LCA modelling of the scenarios under consideration show that the abandonment of biodegradable waste disposal at landfills leads to significant GNG reduction. The global warming as the focus of our research is illustrated by Fig. 5 and Table 7 for all the scenarios.

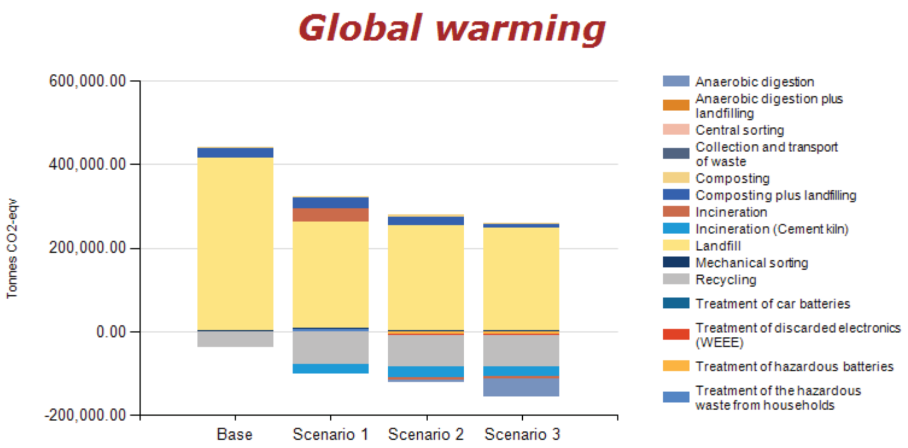

Fig.5: Overview of global warming in the studied waste management scenarios (tonnes CO_2 eqv*)*

The diagrams in Fig. 5 show the net emissions from each WM technology minus the saved emissions in the background system. The negative results imply the avoided impacts and fossil fuel savings.

According to the modelled scenarios, the total GHG emissions can be reduced from 404 700 tonnes CO_2 eqv in Base scenario to 222 127 tonnes in Scenario 1, 158 526 tonnes in Scenario 2, and to 92 333 tonnes in Scenario 3.

Table 7

Global warming emissions for each waste treatment technology (tonnes CO^2 eqv.)

	Anaerobic digestion	Composting	Composting plus landfilling	Incineration (WfE)	Incineration (Cement kiln)	Landfill
Base	-	2 981	23 159	-	-	415 037
Scenario 1	-	4 526	24 569	-32 346	-24 497	255 230
Scenario 2	-6 836	5 891	20 746	-7 152	-24 104	252 958
Scenario 3	-43 162	5 422	8 301	-6 284	-22 853	246 070
	Mechanical sorting	**Recycling**	**Treatment of discarded electronics (WEEE)**	**Treatment of hazardous batteries**	**Treatment of the hazardous waste from households**	
Base	1 619	-36 533	-1 548	-109	95	
Scenario 1	1 485	-76 897	-1 998	-4 842	-1 662	
Scenario 2	1 372	-76 897	-1 998	-4 842	-1 662	
Scenario 3	1 016	-76 897	-1 998	-4 842	-1 662	

6. CONCLUSIONS

In the work it is convincingly shown that landfilling (Base Scenario) as the final disposal waste treatment method is the major source of GHG emissions (mainly CH_4), since the effectiveness of recovering the landfill gas is low.

A significant net positive environmental impact has been made by the use of material recycling and incineration (especially in a cement kiln). In these processes the heat and electricity are produced, which allows for saving virgin materials and fossil fuels, also reducing the disposed waste amount at landfills.

The sorting of food waste at source which reduces its content in the fine fraction for composting and landfilling widens possibilities to use such waste as valuable material and to reduce significantly disposed waste at landfills. Also, the food waste separated at source presents a useful input material for the energy recovery and production from biogas which would partly replace the energy derived from fossil fuels (coal, oil, gas).

Composting may result in CO_2 emission arising in the decomposition process of organic matter, also after the compost is added to the soil and from turning mechanically a compost pile. At the same time, if the composting process is managed properly, no CH_4 emission arises from anaerobic decomposition.

The current statistics shows insufficiency of reliable data on the produced food waste amount and its content, which reduces the effectiveness of waste treatment planning. Therefore, the results of our pilot research are of vital importance.

In the future, for WM system an essential requirement will be to prepare food waste for anaerobic digestion in the planned amount and with invariable quality; therefore, thermal stabilisation of food waste is desirable.

In order to make feasible the anaerobic digestion of food waste – since composting only food waste without any other organic material will be extremely difficult – it is necessary to create new or integrate the existing alternative systems for energy consumption. It is rational to combine the production facilities with agriculture, transport or other ones.

The green waste composting is a rational option when the produced compost is valuable and is needed as soil improver. Therefore, government has to create legislative and economic instruments for adequate stimulation of the compost market and of using the produced material for landscaping, road construction, etc.

In the case of Latvia, home composting in private houses is very feasible, making it possible to significantly reduce the amount of treated municipal waste. Therefore, the local municipal support and the campaigns of home composting awareness are extremely important.

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BIOLOĢISKI NOĀRDĀMO ATKRITUMU APSAIMNIEKOŠANAS UZLABOŠANA SILTUMNĪCEFEKTA GĀZU SAMAZINĀŠANAI

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K o p s a v i l k u m s

Rakstā veikts pašvaldības bioloģiski noārdāmo atkritumu apsaimniekošanas statistikas datu novērtējums atbilstoši likumdošanas prasībām. Izmantojot matemātisko modelēšanas programmu WAMPS, analizēti trīs dažādi bioloģisko noārdāmo atkritumu apsaimniekošanas scenāriji, kuriem veikts vides ietekmes novērtējums, kas izteikts klimata pārmaiņu potenciālā – tonnas CO_2 ekv.

Darbā secināts, ka lielākais siltumnīcefektu (SEG) avots atkritumu apsaimniekošanas ir atkritumu poligoni (Bāzes scenārijs), ko galvenokārt ietekmē CH_4 rašanās, organiskajiem atkritumiem sadaloties anaerobos apstākļos. Būtisku pozitīvo efektu SEG emisiju samazināšanā dod atkritumu pārstrāde otrreizējās izejvielās un sadedzināšana cementa ražotnē, kas ļauj samazināt dabīgo izejmateriālu un fosilo enerģijas resursu patēriņu.

Attīstot pārtikas atkritumu pārstrādi biogāzē, lietderīgi veidot alternatīvās vai izmantot esošās sistēmas, kas nodrošina iegūtās enerģijas un digestāta patēriņu, t.i lauksaimniecība, transports vai komunālie pakalpojumi.

Lai no zaļajiem dārza atkritumiem iegūtu augstvērtīgu kompostu, valstī jārada tam nepieciešami likumdošanas un ekonomiskie instrumenti, kas veicina komposta tirgus attīstību.

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