Finding sound bio-waste treatment solutions in the Baltic states

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European Union (EU) Landfill Directive 1999/31/EC targets for decreasing of biodegradable municipal waste disposal in Baltic states



Content of municipal waste in Baltic states (% by weight in 2010)



Generation, collection, landfilling and recycling of municipal waste (kg per capita in 2010)



Waste treatment in the Baltic states in 2010 and 2012 (% from weight)

Country	Landfilled		Recycled		Composted		Incinerated	
	2010	2012	2010	2012	2010	2012	2010	2012
Lithuania	94%	79%	4%	19%	2%	2%	-	1%
Estonia	76%	44%	14%	34%	9%	6%	-	16%
Latvia	90%	84%	9%	14%	1%	2%	-	-

Composting of green waste in Marupe (Latvia)







MSW mechanical Pre-treatment (drum and disc screening)







- Metal (60-120 mm) ~1.5-3%;
- Fine or organic fraction (<60 mm) ~43-47%;
- Coarse fraction (>120 mm) ~ 50-55.5%:
- for RDF production 45-50%;

- impurities 5-8% (kitchen waste ~1%, inert (glass, stone) ~3%, aluminium cans 1%).



- Metal ~ 2-3%;
- Fine or organic fraction (<25 mm) ~30-36%;
- Medium fraction ~ 38-43%;
- Coarse fraction (>60-80 mm) ~ 18-25%

Incineration plant in Tallin (Estonia)



Incineration plant in Klaipeda (Lithuania)



Overview of WAMPS modelling possibilities



For modelling purposes, the data input is available in five consecutive steps:

- Detection of waste composition (input data for 24 waste fractions and amounts);
- Selection of waste sorting activities (recycled waste material from each waste fraction at source);
- Selection of waste treatment and disposal methods (composting, anaerobic digestion, recycling, incineration, combustion, landfilling);
- Local waste collection where the environmental performance related to waste collection is represented;
- Waste transportation for long distances (specifies parameters affecting the environmental performance for long distance transportation).

Location of Waste Management Regions in Latvia



Characterization of case study municipalities in Pieriga Region

	Number of	inhabitants	Total	2	Average density, capita / km ²	
Municipality	City	Rural area	inhabitants	Area, km ²		
Ikskile	4 022	4 825	8 847	132,1	67,0	
Lielvarde	6 688	4 712	11 400	225,7	50,5	
Baldone	2 362	3 362	5 724	179,1	32,0	
Kegums	2 485	3 794	6 279	492,2	12,8	
Ogre	26 549	12 684	39 233	992,35	39,5	
Total	42 106	29 377	71 483	2021,45	12,8-67,0	

Breakdown of municipal waste producers by source (% of total)

Municipality	Institutional	Small commercial	Households in apartment houses	Households in private houses and detached houses	
Ikskile	10%	19%	26%	44%	
Lielvarde	9%	4%	46%	41%	
Baldone	23%	13%	32%	31%	
Kegums		5%	95%		
Ogre		22%	71%	7%	

Municipal waste composition (data from Ogre municipality)



Content of municipal waste fractions sorted by sieves with meshes 300 mm, 150 mm, 70 mm



Average composition of mechanically sorted municipal solid waste fractions (for dry mass)

Waste type	Coarse fraction,%	Medium fraction, %	Fine fraction, %	
Paper/cardboard	39,5	23,9	2,4	
Plastic	38,7	24,5	2,1	
Putrescible green waste	0,7	6,6	12,3	
Small particles (<10mm)	3,2	6,3	43,7	
Hygiene (diapers, pads)	5,1	7,1	0,7	
Textile	5,5	4,0	0,1	
Rubber/ leather	4,1	3,4	0,1	
Wood	1,1	3,6	0,5	
Metal	1,5	3,5	0,5	
Glass	0,2	9,1	32,1	
Inert minerals, ceramics	0,4	8,0	5,5	

Average characteristics of waste fractions

Size of fraction	Contents of	Heating value	Content of	Content of	Content of		
	moisture (%)	(lowest)	ashes (%)	S (%)	Cl (%)		
Coarse (X>60-80 mm)							
Summer	43	13	17	0.2	1.1		
Autumn	36	13	19	0.2	2.2		
Winter	36	20	8	0.1	0.2		
Spring	24	14	9	0.3	0.3		
Medium(10-25 <x<60-80mm)< td=""><td></td><td></td><td></td><td></td><td></td></x<60-80mm)<>							
Summer	49	11	15	0.3	4.1		
Autumn	48	8	32	0.2	0.7		
Winter	43	11	33	0.3	1.7		
Spring	30	15	12	0.9	0.5		
Fine (X<10-25 mm)							
Summer	49	7	46	0.2	2.0		
Autumn	44	3	63	0.2	0.2		
Winter	49	5	65	0.2	0.3		
Spring	26	7	79	0.2	0.1		
Requirements for RDF material of the local cement kiln							
50 x 50 x 5 mm	<25 %	16 MJ/kg ±1	<15%	<1%	<0,8%		

Selected scenario for assessment of Environmental impact



Environmental impact assessment of waste management development

Global warming



Eutrophication



Photo oxidant formation



Acidification



Environmental impact of waste management in the Baltic states (tonnes CO2 eq. per treated tonne)

Category	Estonia_2010	Estonia_2012	Latvia_2010	Latvia_2012	Latvia_2020_1	Latvia_2020_2	Lithuania_2010	Lithuania_2012
Tonnes CO ₂ - eqv/ per ton	0,72	-0,14	1,04	0,96	0,48	0,27	1,18	1,03

Conclusion

- The LCA approach to the waste management development planning process applied in this research using the WAMPS software allows waste management decision-makers and planners to better understand and estimate the environmental impact of waste management development trends according to the chosen scenario.
- As evidenced by the results obtained, the disposal of unsorted household waste at landfills creates the greatest environmental impact. Contrastingly, any of the other offered technologies makes it possible to avoid direct organic mass disposal at landfills and reduce GHG emissions substantially.
- The development of bio-waste sorting at source allows not only to reduce the amount of disposed waste but also to decrease the moisture content of the unsorted waste mass. As a result, the scenarios should be preferred with an inclusion of waste incineration technologies.
- The results of the evaluation of separate collection and treatment costs for bio-waste show that the treatment of such waste is more expensive than for other types of waste material. This is one of the reasons why waste collection companies today show a low interest in bio-waste collection and treatment.
- For the elaboration of more exact forecasts of waste management development in the Baltic states by using a software tool, more precise data are required, e.g., waste producers, composition, and the applied waste treatment technologies. As the applied input data from Eurostat data bases are of insufficient quality for LCA and estimation of the environmental impact of waste management development scenarios, the obtained results are only indicative and show the trend of waste management development in each country.