Newest trends/technologies in municipal waste management - Estonian examples

RECO conference

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Outline

- Background
- Criteria for evaluating technical alternatives
- Optimal municipal waste management scenarios – results of Tallinn case study

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Problems of municipal solid waste management

- We are a wasteful society. 20% of food goes straight into the waste bin.
- Municipal solid waste growth is ca 5% per year
- Nearly 90% of waste is landfilled
- Landfills contribute 25% of total emissions of methane
- Nobody wants a landfill anywhere near their neighbourhood (NIMBY)

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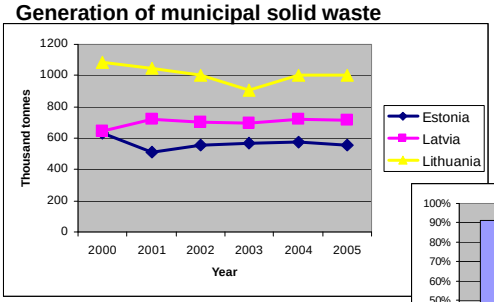
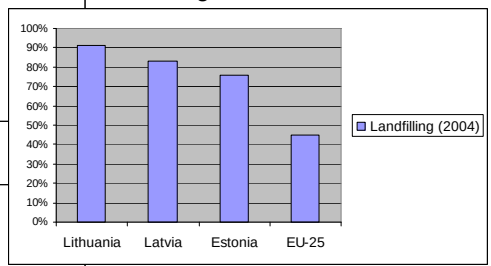
Municipal solid waste management in the Baltic States

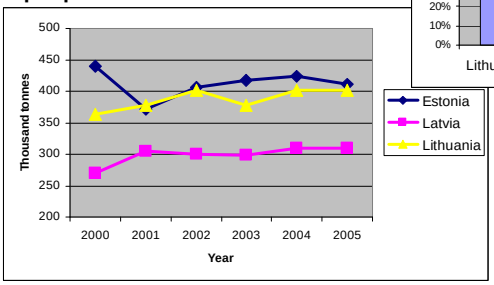
Generation of municipal solid waste



Landfilling 2004



Generation of municipal solid waste per person



Source: Eurostat

Waste hierarhy

Targets for promoting recycling:
•Landfill Directive - sets demanding targets to reduce the amount of biodegradable waste landfilled
•Packaging Direcive - recycling targets for packaging waste

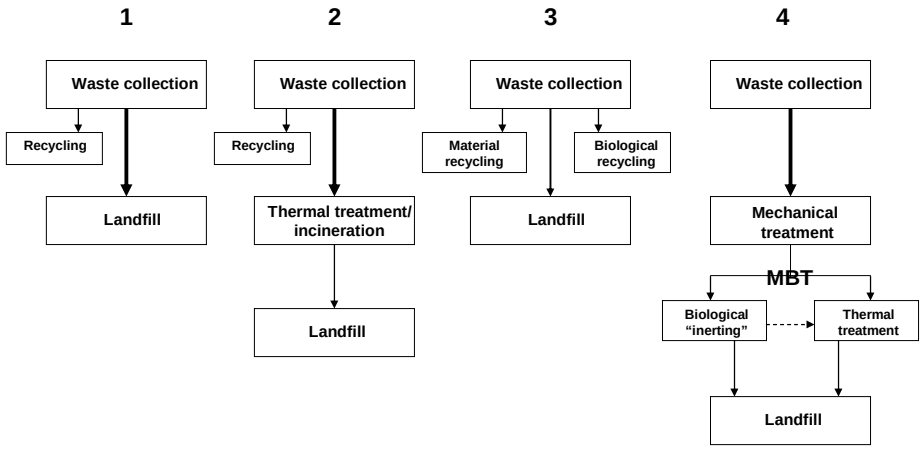
The need for planning

- In order to develop a well-integrated and cost-effective MSW system, decission-makers must evaluate how well each potential piece of the system fits in to the context.
- Individual elements/technologies of the waste management system should be:
  - **chosen so they do not overlap or compete excessively;**
  - **sized so they can handle the portion of the waste stream they were designed for ;**
  - **located so that transportation costs between management facilities are minimized and appropriate transportation networks are used;**
  - **owned, operated, and financed to minimize overall public costs, while ensuring responsible management and cooperation with other system elements;**
  - **administered by appropriate agencies, with adequate public oversight.**

Criteria for evaluating alternatives

- Is the proposed technology likely to accomplish its purpose in the circumstances where it would be used?
- Focusing on the financial aspects of the practice, is it the most cost-effective option available?
- What are the environmental benefits and costs of the practice?
- Is the practice administratively feasible and sensible?
- Is it practical in the given social and cultural environment?

Basic technical alternatives for MSW management



LCA model for waste management planning - WAMPS

- Screening level LCA tool for assessing environmental and economic aspects of different waste management systems/scenarios (developed by Swedish Environmental Research Institute)
- Based on a more complex LCA model ORWARE
- Environmental assessment
  - 4 impact categories: global warming, eutrophication, acidification and photooxidant formation
- Environmental cost
- Economy (financial costs): investments costs, operational costs, revenues, taxes and charges
- Welfare economy (environmental plus economic costs)

Case study in Tallinn region

Predicted waste management situation in 2013

Population	**525 000**
MSW generated (t)	**300 000**
MSW generated (kg/cap)	**570**
Share of biodegradable waste of total MSW	**60%**
Share of packaging waste of total MSW	**30%**
Number of households	**215 000**
Number of detached houses in city area	**35 000**
Number of detached houses in rural areas	**13 000**

Waste management scenarios

- Considered issues:
  - Directive compliant landfill - it is assumed that 50% of the landfill gas is recovered and used for electricity and heat production
  - Gross efficiency of energy recovery from incineration process is 80%
  - Energy from incineration is substituting fossil fuel (oil-shale for electricity generation and natural gas for heating)
  - Scenario 5 – only non-fossil fuel is substituted (biofuel for both electricity and heat)
  - Scenario 3 - kerbside collection of both residual waste and source-separated fractions
  - Economic costs – local survey, European average
    (Approximate cost functions for solid waste treatment facilities, Waste Management&Research 2006:24)

Waste management scenarios

Scenario	Material recycling	Biological treatment - composting	Incineration	Landfilling
0 Base scenario	17%	6%	0	77%
1 Min recycl + incin	24%	10%	33%	33%
2 Min recycl + comp	25%	33%*	0	42%
3 Max recycl + incin	29%	0	66%	5%
4 Max incin	0	0	95%	5%
5 Max incin (biofuel)	0	0	95%	5%

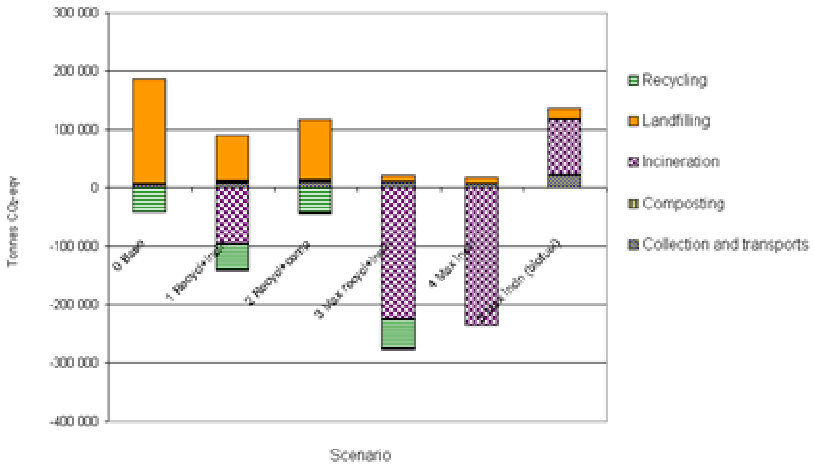
Base scenario is based on the existing management situation in 2005

Scenario 1 and 2 take into account the requirements and recycling targets of Packaging Directive 2004/12/EC and Landfill Directive 1999/31/EC

***Compliance with target for 2013 (Waste Act): biodegradable waste shall be reduced to 30% of total amount of waste landfilled**

Results

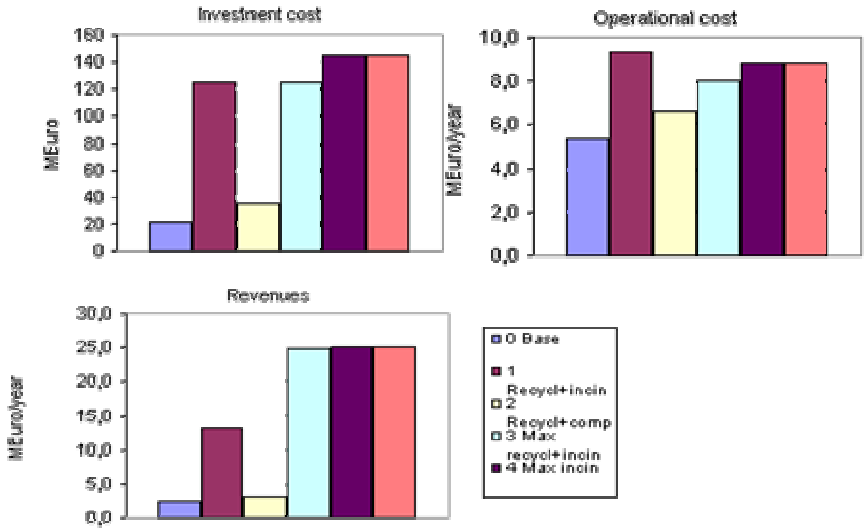
Environmental profiles of different options



Emissions of greenhouse gases

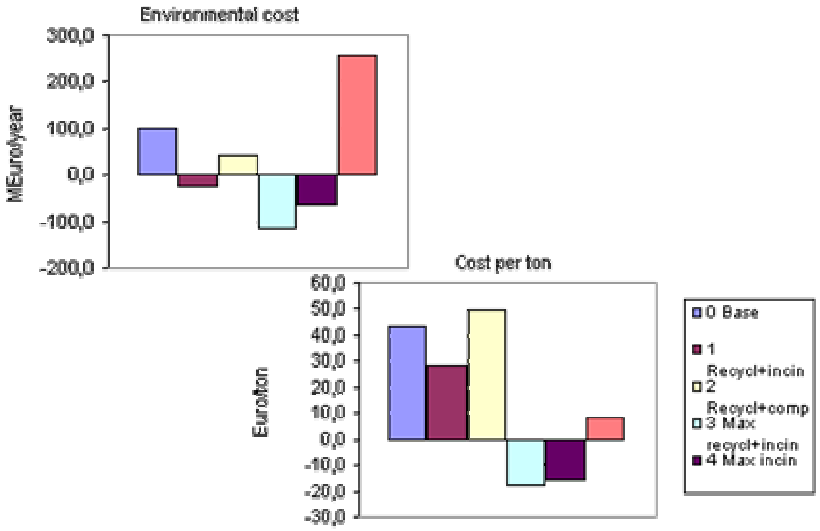
Results

Economy



Results

Environmental cost and welfare economy



Conclusions

- Significant benefits can be obtained through reduction of waste deposited to landfill
- Recycling and incineration with energy recovery are environmentally preferable technologies
- The balance between recycling and incineration is not studied, but from other studies we have seen:
  - recycling of metals is always favourable compared to all other options.
  - recycling of plastics is also always more favourable than incineration, however the differences are relatively small when incineration substitutes fossil fuel
  - incineration of paper is usually more favourable than recycling when incineration substitutes fossil fuels
- Incineration is not so favourable if biofuel is substituted
- Composting without energy recovery can be motivated if landfilling is avoided and incineration is difficult to realise

Conclusions

- Collection and transport of waste plays a small role, considering the environmental impacts studied. At the same time the design of collection system could influence significantly the collection cost

- The optimal scenario for Tallinn region – maximum recycling with incineration

Conclusions

- Local conditions could have a significant impact
- Several uncertainties
  - Waste generation and structure
  - Energy (e.g future energy price, marginal electricity source)
  - Economic costs of waste (additional) collection - particularly for biowaste
- Need for long term forecasts of waste amounts to avoid overinvestment in incineration capacity and the consequent technological lock-in
- Since different stakeholders have different interests it could be good that different aspects are separately analysed

For more information:

www.baltema.org/reco