Technology selection

Framing waste treatment within the overall waste management cycle

D-WASTE™ waste management for everyone

Contents

- Few words about D-waste
- Framing the technologies
- Understanding technologies
- Criteria and procedures for decision – making
- Conclusions and lessons learnt

FRAMING TECHNOLOGIES

Useful tips to remember before selecting a technology

Keep in mind:

All waste management technologies as well as recycling are not religions

They are business & technologies that can provide solutions to environmental problems.

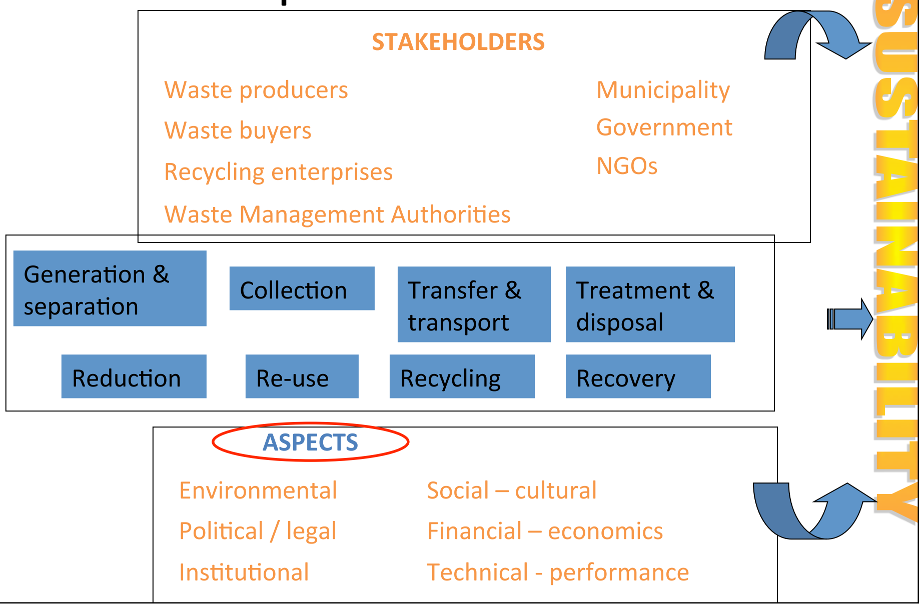
No solution is the devil

No solution is the savior

The right to choose…

- Finally, you have to choose technological options to be applied – this is not an easy nor quick procedure
- There is no generally accepted methodology to use, you have to create your own unique one according local conditions and global experiences
- You have to combine environmental, financial, technical, social as well as political criteria

The whole picture in mind



The most common mistake

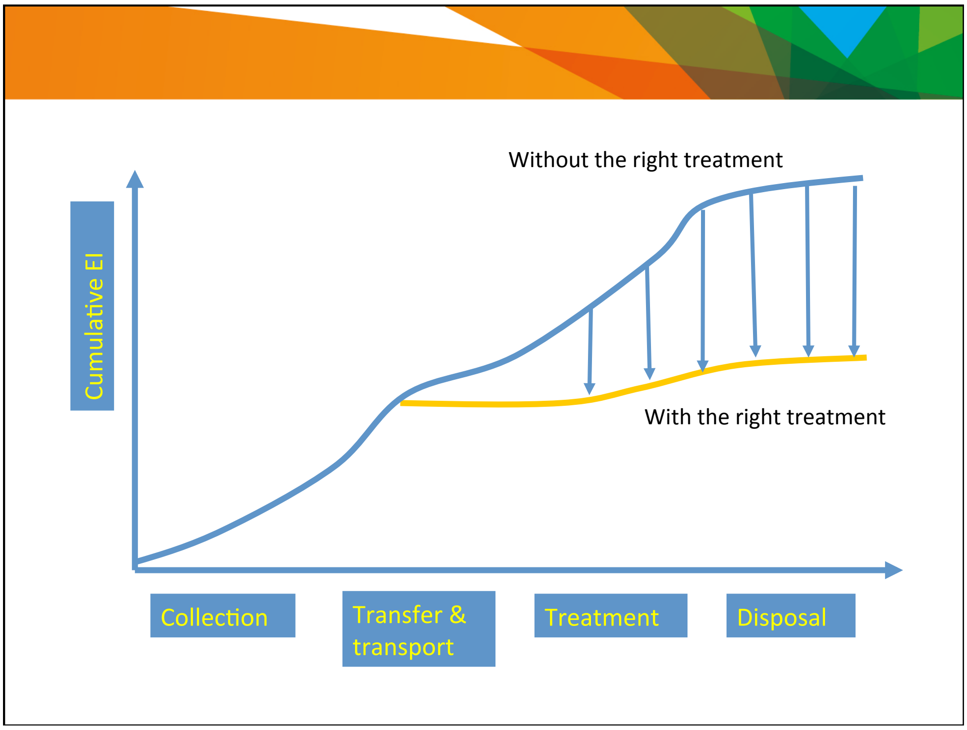
- "Waste management is something about public works, equipment and money"

Understanding SWM Change means understanding social and technological change

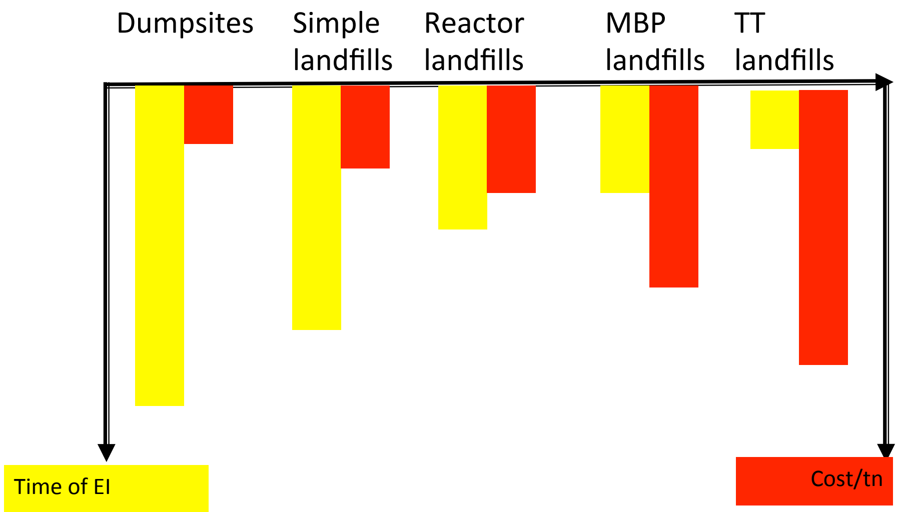
Social relations
Local Culture
Politics
Income
Behavior
Institutions

Scope of technologies

- ❑ Changing the waste physical and chemical properties → Reduction of environmental impacts of waste disposal
- ❑ Recovery of material and energy
- ❑ Reduction of waste volume & Increase of lifetime of landfills
- ❑ Minimization of natural resources depletion



Technologies need landfills



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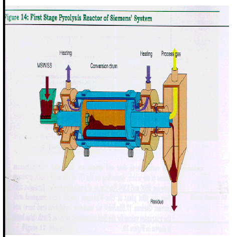


Pyrolysis

Gasification

Incinerator

MBT

RDF

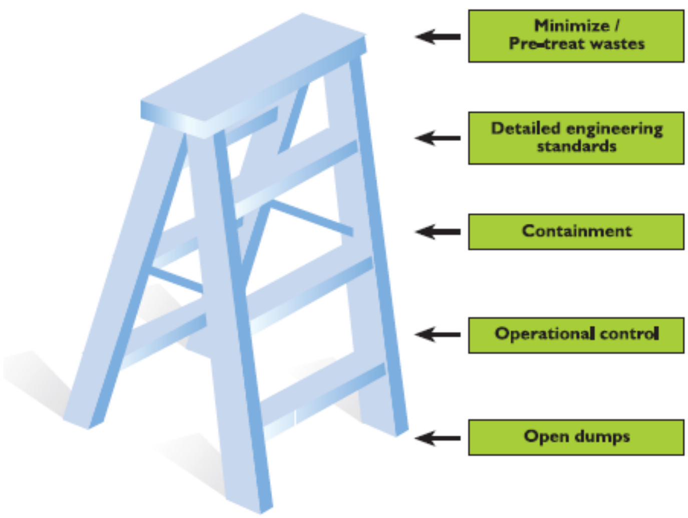
Remember…

- All modern waste management technologies are more or less expensive both in investment and operation
- EU standards landfills cost 10 - 50 €/ ton
- Incineration with EU standards of non-hazardous MSW costs 60 - 200 €/ ton
- MBT costs between 18 – 70 €/ ton

Do not ignore that…

- The long – term viability of a technology is strongly linked with the GDP/c evolution and the money available for waste management activities from each household
- Even a donation of physical infrastructure does not change the financial and institutional conditions of your city
- SWM systems are not evolving by huge shifts but rather by gradual improvements and upgrades

Follow a stepped approach…



UNDERSTANDING TECHNOLOGIES

Key-issues and facts

The main problem from SW

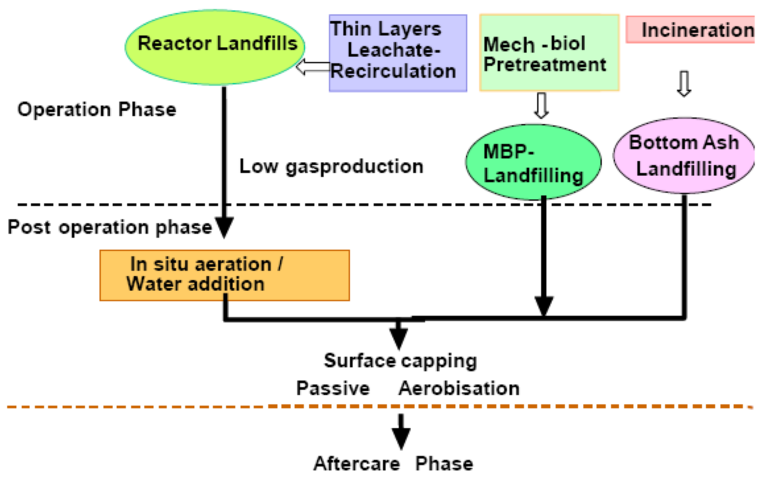
- All major health and environmental impacts by inappropriate municipal sold waste management are directly linked with the organic fraction
- So the biggest problem that a treatment has to resolve is how to eliminate or reduce the impacts from the organic fraction

Sustainable landfill

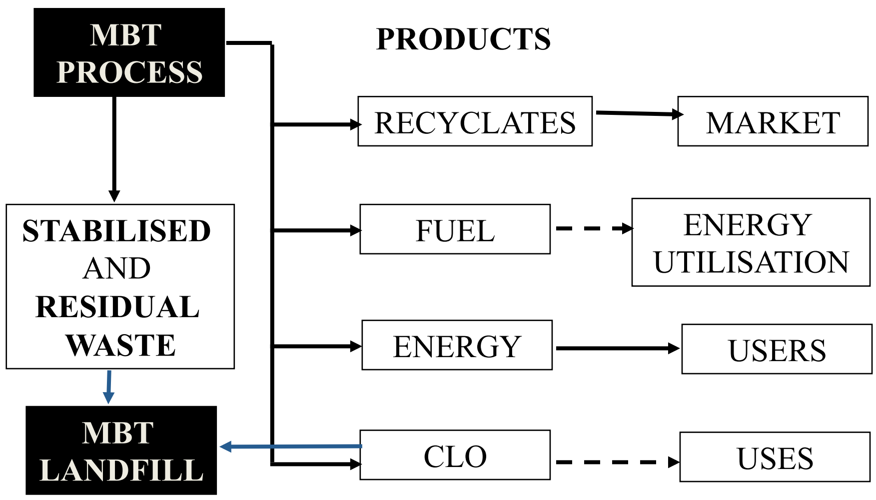
Sustainability in practice

- Completion of environmental impacts during operation
- Minimization of post closure needs
- New land uses as soon as possible

Different ways to achieve it



MBT concepts



MBT key - issues

- The most flexible option in both quantities and composition of waste
- It produces recyclables (but not as clean as the source separated) and CLO (compost like output)
- Depending on the further treatment of the CLO, there might be several markets for it – otherwise it goes to the landfill
- MBT can reduce the waste volume by 40% -60% depending on the process
- MBT diverts organic fraction from landfills in the form of CLO – but if CLO is not marketable, the volume reduction is just 25%
- It is affordable with prices from 20 – 80 $/ton, depending on the process and the financing scheme
- Scale economies realized above 200.000 tons/year

Thermal treatment: EU example

WtE: Complementary in the Energy Production System

- **provides electricity and heat**

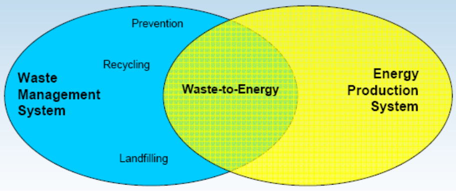
50 million tons of MSW annually treated

27 million MWh of electricity
(= population of the NL, Denmark and Finland)

63 million MWh of heat
(= population of Austria, Ireland and Estonia)

12

The role of Waste-to-Energy



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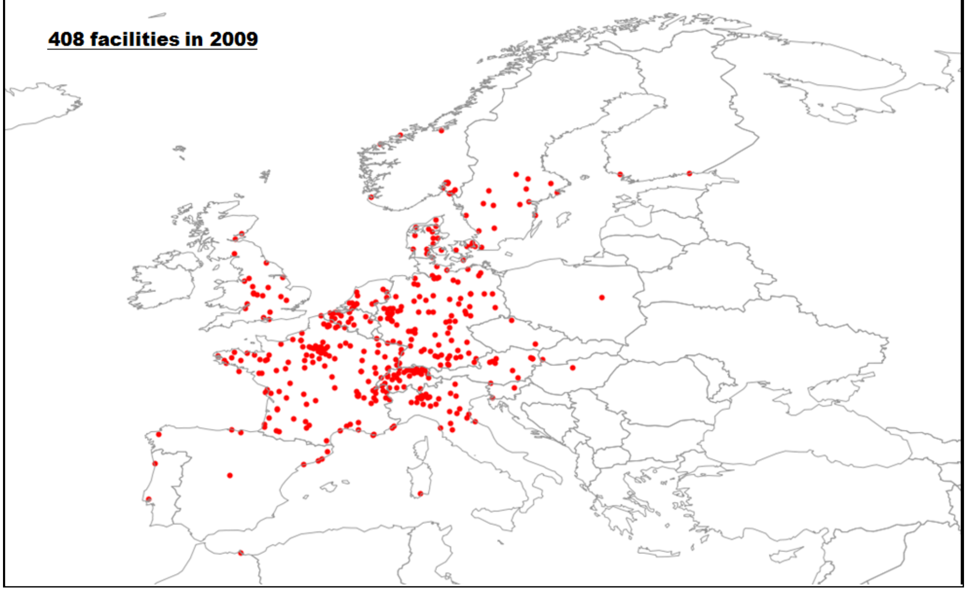
Treatment according to specific technologies

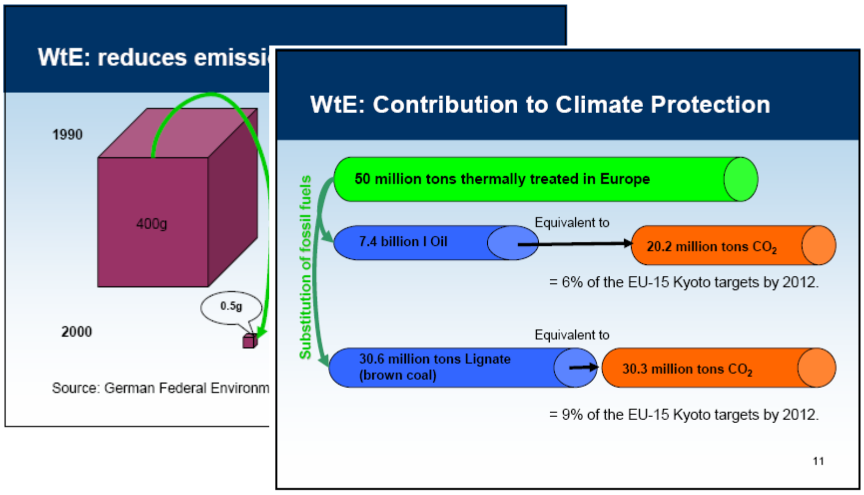
22

E-PRTR Facilities: Incineration of non-hazardous waste included in Directive 2000/76/EC - waste incineration

408 facilities in 2009



Emissions control



Thermal treatment key-issues

- Scale dependent for operational conditions and prices
- Scale economies realized above 400.000 tons/year
- It produces electricity and thermal energy – if we sell both of them the plant is definitely viable
- It also produces bottom ash (easily neutralized and reused with some further treatment) and the toxic flying ash (needs special treatment)
- It can reduce the waste volume by 70% - 85% depending on the process
- It completely transforms organic fraction to ash and thus eliminates all relevant environmental impacts
- It is more expensive with prices from 50 – 150 $/ton, depending on the process and the financing scheme

How about gasification and plasma and pyrolysis?

- They still lack commercial applications
- Their energy efficiency is a big problem
- They need uniform feed-in and waste is by definition on-uniform
- This is why those techniques usually are not promoted through official tendering but through other paths
- However, if there will be a substantial improvement due to technological advances, those techniques will be the next generation of commercial solutions

First conclusion

- There is not an easy way to select treatment technology because we must combine social, financial, commercial, technical and environmental data
- We need a method to select something that will affect all ISWM issues for decades

PROPOSED METHODOLOGY

Criteria and procedures for technology selection

Provide alternatives

- Options must have the form of scenarios
- Scenarios must be described by indicators
- Indicators must be in accordance with evaluation criteria

Scenario development

1st step: generation of profiles

Area profile

Waste treatment technologies profiles

2nd step: Screening

Technical screening (limits of feasibility)

Financial limit (levels of affordability)

Utilization of end products – market issues

Scenarios passed screening tests → **Detailed scenarios**

Select and Calculate the Indicators

- Climate change indicators
- Air pollution indicators
- Transport indicators
- Water indicators
- Land-use indicators
- Waste minimization / treatment indicators
- Capital cost
- Operational cost/ ton

Remember dimensions of ISWM

- Stakeholders
- Waste systems elements
- ISWM aspects
  - Environmental
  - Political / legal
  - Institutional
  - Social – cultural
  - Financial – economics
  - Technical - performance

Product and market issues

- Compost like output
- Secondary fuels
- Recyclates
- Energy

Combine environmental and financial issues

- Quantify environmental impacts
- Try to be accurate with cost analysis
- Be aware of operational costs
- Use externalities or LCA if possible
- Describe the changes to all the waste components
- Give emphasis to qualitative issues e.g.competition between different components

Be aware of the whole picture

Investment cost
Operational cost
Income from energy

Savings in logistics?
Landfill closure
Landfill aftercare
External costs
Cost of land
Ash treatment
Ash transfer
Product transfer and disposal

CONCLUSIONS

And lessons learnt

Failures to remember

Delhi 1984

- In 1984, the Municipal Corporation of Delhi, India, built an incinerator to process 300 ton per day of solid waste and produce 3MW of power, with technical assistance from Denmark, at a cost of around US$3.5 million.
- The plant was designed for segregated waste as input, which was not practiced by the households or promoted by the municipality.
- The plant had to be closed down within a week of its opening as the waste had a very low heating value and a high percentage of inert materials.

Philippines, Indonesia 1990-93

- During the early 1990s, many incineration plants installed in some cities in the Philippines and Indonesia with World Bank assistance → ended up as White Elephants
- Why? They were never used because the high organic content of the waste streams meant that the waste was not incinerable.

Nairobi 1993

- An extreme example is the incinerator that was marketed to a Nairobi private waste collector by a Swedish company in the 1990s, with the 'guarantee' that it would burn garbage and turn it into hundreds of liters of clean drinking water
- After two hours examination of the proposal by two independent consultants it turned out that the system simply was not existing and the real purpose of the company was to sell some exhausted equipment.

Mexico City, 1997

- A whole fleet of Collection Vehicles were donor-provided.
- The vehicles were fitted with tires of an uncommon size, which were not available locally.
- So when the tires needed replacing, the vehicles could no longer be used.

Thessaloniki 1998

- A network of transfer stations is designed for 200.000 tons / year
- High compaction equipment will prepare waste compacted up to 700 kg/m3
- As soon as the design was finished it was found that it could not work
- Why? Because so high compaction rate will make the recycling facility before the landfill useless as mechanical separators and hand pickers will not be able to segregate waste materials

Pecs 2000

- Hungary, Pecs 2000: Sanitary landfills built to meet EU environmental standards → revert to being operated as an open dumps because energy costs of the leachate collection system or fuel costs of operations are too high.

Delhi 2003

- In 2003, Lucknow Municipal Corporation built an anaerobic digestion plant, as a 5MW waste-to-energy project, to process 500 to 600 tons of municipal waste per day at a cost of US$18 million.
- Private companies from Austria and Singapore provided the technical inputs, while Indian firms supplied the human resources for execution on a build–own–operate (BOO) basis.
- The plant was not able to operate even for a single day to its full capacity due to the high level of inert materials in the waste and was closed down.

Cairo, 2008-2009

- Government privatized waste management collection, recycling and disposal with a single global contract
- Zabaleens, the informal sector that made door to door collection and lived from recycling of organic fraction and packaging materials, were completely ignored
- The contractor put high tariff (almost triple than Zabaleens) and households served by Zabaleens never paid – instead they asked Zabaleens to continue their services although they were characterized as illegal
- The contractor gave up the contract and asked for a huge compensation

Lessons to learn…

- Keep the whole system in mind and not just the final part of treatment and disposal (Thessaloniki, Cairo, Delhi) – be aware of the informal sector
- Technologies may be imported but they are going to work with local waste (Delhi, Philippines, Indonesia)
- Technologies may be donor – funded but they will be operated, maintained, paid and supported by local resources, markets and citizens (Mexico, Delhi, Cairo)

And last but not least

- Create a capable project management team
- Prepare your own framework of analysis
- Communicate with all stakeholders
- Combine technical preparation with the right communication campaigns
- Frame the waste treatment unit within the overall waste management cycle and look for implications before and after it