

Sustainable Material Recovery from EU-Landfills

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1. INTRODUCTION AND OBJECTIVE

The ultimate ambition is a world without waste, which is the ideal situation according to the principle of Cradle to Cradle®. However it takes some time before this will become reality. In the meantime a transition-process is currently going on from the traditional waste management (recycling, incineration, landfilling) to sustainable material management. Or in other words: a shift in awareness from reducing the negative impact of waste management to the added value of the positive impact of resource recovery and chain management. During this transition process and taking into account the approaching scarcity of raw materials and precious metals, we should try to manage our waste as sustainable as possible.

From that perspective it also can be justified to examine the added value of recycling our 'historical' waste, which has been landfilled all over Europe in the last 50 years. Europe counts over a 150,000 landfills, which represents an estimated total volume of 30 to 50 billion m³ of waste. This huge quantity of waste also represents a huge potential of materials to be recovered and recycled (MFL¹) and/or of energy from additional biogas (methane and carbon dioxide) to be recovered using the concept of sustainable landfill management (SLM).

Of course a profitable exploitation of resource recovery and/or energy recovery from landfills depends on a lot of factors such as the spatial distribution of the landfills, the specific local circumstances such as tax regime, supply and demand of raw materials, the market prices of raw materials and precious metals. This varies per EU-country. Nevertheless, in times of climate change and an approaching shortage of raw materials and precious metals, it is an opportunity to deal with our existing landfills in an environment-friendly way fitting in the framework of resource recovery and chain management.

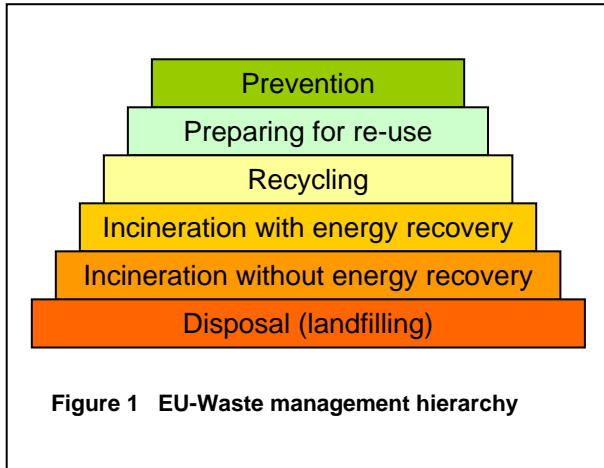
The **objectives** of this note are:

- to create awareness of and to call your attention to the huge potential of raw materials to be recovered and recycled from 'historical waste' in the European Union.
- To call upon the willingness of the relevant European stakeholders to support this initiative and to participate and invest in a step-by-step examination of the feasibility and viability of this businesscase.

¹ **MFL** stands for **M**aterials **F**rom **L**andfills

2. BACKGROUND INFORMATION

2.1 The European waste hierarchy



According to the European Directive 2008/98/EC of 19 November 2008 on Waste, the waste hierarchy presented in figure 1 shall be applied as a priority order in waste prevention. It should therefore be implemented into policies and subsequently legislation. Simultaneously EU-directives declare that measures shall be taken to encourage the options that deliver the best overall environmental outcome. This means that the treatment of specific waste streams may deviate from this waste hierarchy if this is justified by life-cycle thinking analysis on the overall impacts of treatment and management of such waste.

2.2 Waste management in Europe

Figure 2 shows how the 27 member states of the European Union process their municipal solid waste¹. From figure 2 can be derived that in the 27 member states of the European Union almost 40% of all municipal solid waste (MSW) is still landfilled. In the Southern and Eastern countries of Europe more than 75% of the waste is landfilled, even up to 100% in Bulgaria.

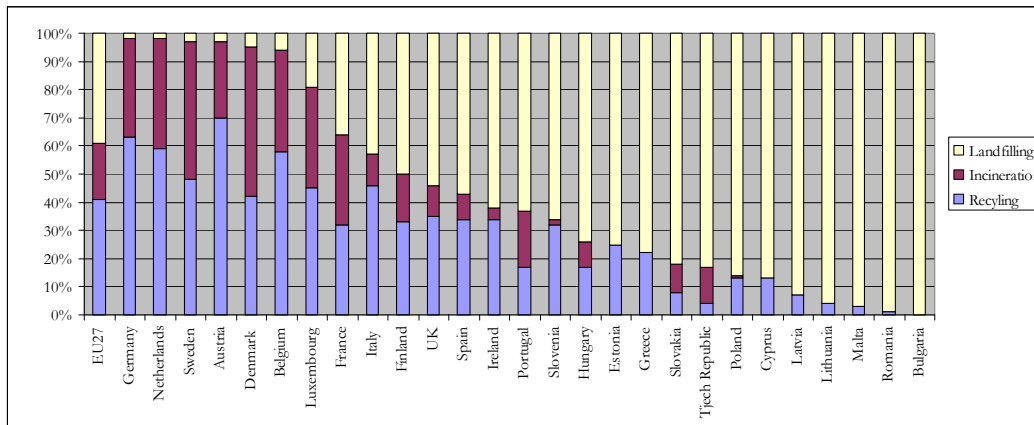


Figure 2 How do the EU member states process their MSW in 2008²

2.3 Landfill categories in Europe

Inspired by our vision on 'resource recovery from historical waste', we distinguish the following categories of landfills and material storage in Europe.

² Source: Dutch Waste Management Association, Annual Review 2009

1. Old landfills, exploited before 1980 and installed without any measures to protect the environment. All kinds of waste have been disposed (no separation of waste at that time).
2. Present landfills, exploited in the last 30 years. These landfills meet the requirements of the EU-directive on the landfilling of waste (1999), which means the installation of bottom- and top-liners to avoid inadmissible emissions to groundwater and air compartment.
3. New sustainable storage to be constructed for not yet recyclable products.

At the landfills of the first two categories all kinds of waste have been disposed such as municipal solid waste (MSW), industrial waste, chemical waste, demolition waste, sludge, etc. At that time separation of waste was not an issue, so these landfills contain a huge potential of materials to be recycled and energy to be recovered.

Furthermore a distinction is made between traditional landfilling (containment approach) and sustainable landfilling. The latter can be subdivided into sustainable landfill management of existing landfills (categories 1 and 2) and sustainable storage of products not yet recyclable (category 3). For the application of sustainable landfill management Royal Haskoning developed the SANA-model^{3,4}.

From earlier research by Royal Haskoning⁵ it has already been demonstrated that the 3,800 old landfills in the Netherlands were less contaminated than expected. At these landfills natural biochemical, geochemical and physical processes have degraded and/or immobilized contaminants since the start of exploitation. Nature has done its work for decades with the result that at over a 75% of all the old landfills the groundwater quality does not exceed the admissible environmental limit values. The acquired knowledge combined with the scientific onus of proof, has been converted to our present landfills by developing the mentioned SANA-model.

Last but not least, sustainable aftercare at old and present landfills can easily be transformed to sustainable storage concepts for products and waste not yet recyclable. In this way knowledge is optimally used following the concept: “the past – the present – the future”.

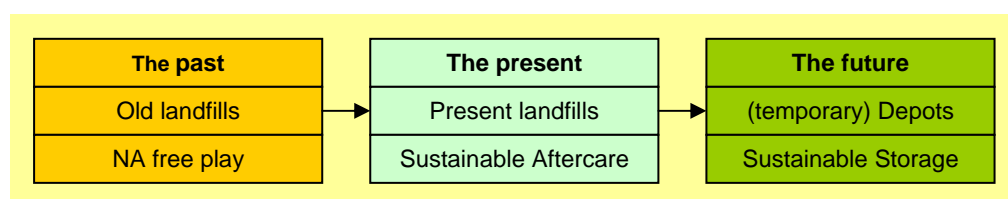


Figure 3 Sustainability at landfills and storage in the past, present and future

3. SUSTAINABLE MATERIAL RECOVERY FROM LANDFILLS

3.1 The sustainable process

³ SANA stand for Sustainable Aftercare based on Natural Attenuation (NA)

⁴ NA stands for Natural Attenuation and represents all natural processes, which are able to neutralize concentrations of contaminants to admissible emission or discharge levels. The three dominating processes are microbial decay, chemical precipitation and sorption to organic matter and silt particles.

⁵ Royal Haskoning, TNO, Bioclear, Free University of Amsterdam, Natural Attenuation and Old Landfills, NA-Verification Methodology and Set of Characteristic NA-Parameters, Integrated Report, IPO-publication number 141, 25 June 2002.

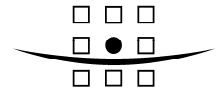


Figure 4 shows an overview of the various possibilities for sustainable solutions for material recovery from historical waste and waste not yet recyclable. It is ment to be a flowchart, by which the best sustainable option(s) in the given local circumstances can be selected.

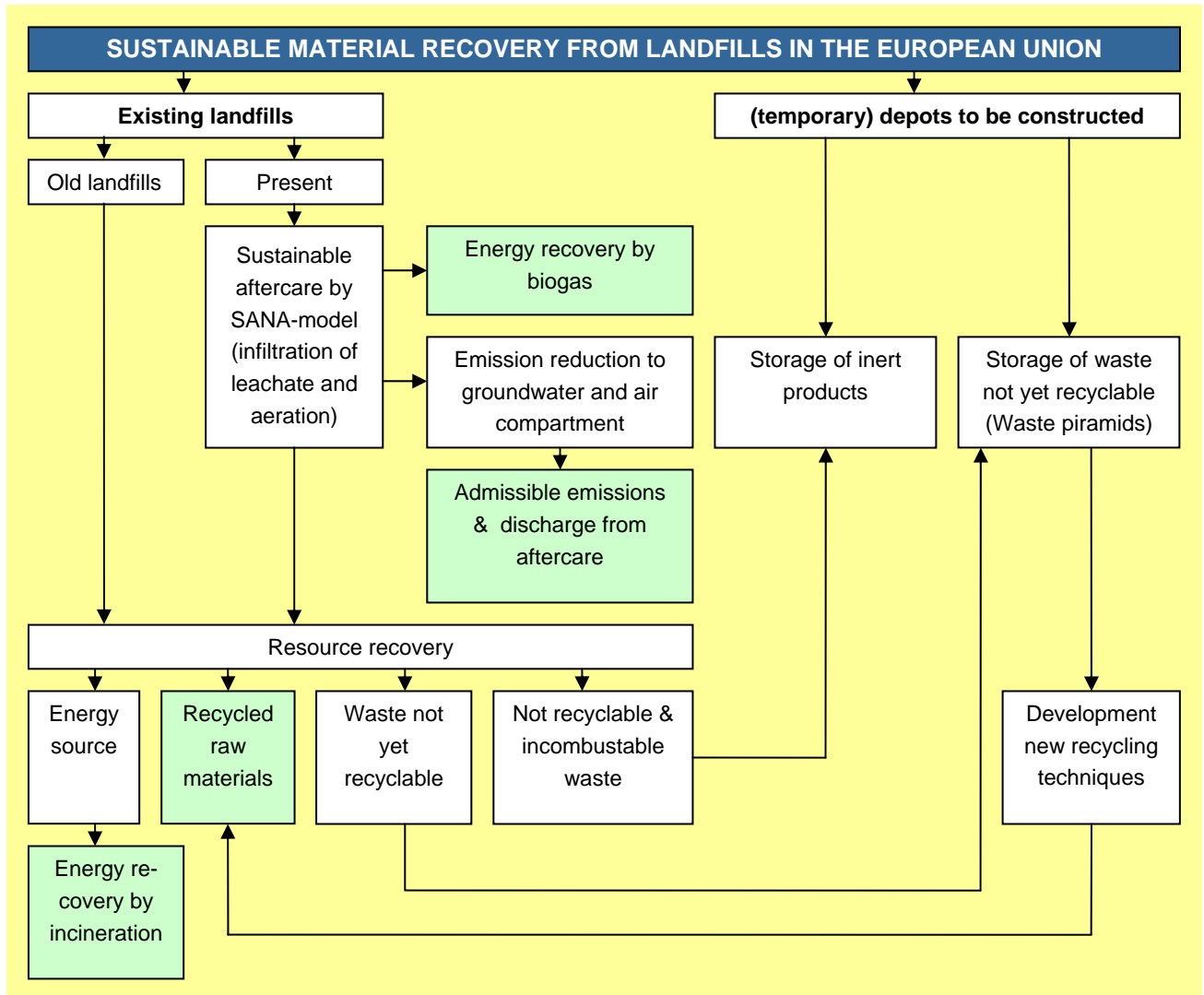


Figure 4 Flowchart Sustainable Process of Material Recovery from Landfills (MFL)

Of course the choices to be made depend on the landfill category, the spatial position of the landfill, the types and volumes of waste streams, the local market with respect to demand and supply of energy and recyclables in relation to the availability and costs of primary raw materials.

In the overview traditional landfilling in terms of isolation the waste from its environment is not included. This containment approach is not considered a sustainable solution. The waste remains as harmful as it was when landfilled. Because of the lack of water all natural processes are stopped in the waste body and as a consequence no sustainable emission reduction will be realized. It burdens the next generation with an unsolved environmental problem.

3.2 The sustainable products

Application of the above mentioned sustainable process, results in the following sustainable products (not exhaustive):

- recycled raw materials and precious metals from 'historical waste';
- recycled raw materials and precious metals on the long term from stored products and waste not yet recyclable;
- a reduction of methane emissions at present landfills by means of sustainable aftercare;
- energy recovery from additional biogas due to sustainable aftercare at present landfills;
- energy recovery by incineration of energy sources, mined from old landfills;
- a clean-up of old landfills (no environmental hazards, no costs of aftercare anymore);
- re-use and redevelopment of former landfill sites into residential and industrial area;
- no burden to next generations due to the unsolved environmental problem of unprotected old landfills.

4. CONCLUSIONS

In times of climate change and an approaching shortage of raw materials and precious metals, it is an opportunity to deal with our existing landfills in an environment-friendly way fitting in the framework of resource recovery and chain management.

Based upon preliminary calculations and experiences with MFL-projects, we strongly believe it is worth while to investigate the viability and feasibility of resource recovery from landfills in Europe.

Simultaneously the MFL-concept helps to get rid off the thousands of competitive old landfills especially in the CEE-countries, which do not comply with any EU-regulations, but are "tolerated" by local authorities due to missing alternatives. So the MFL-concept will also enhance the position of the current landfills, which surely comply to all EU-regulations.

In the EU-countries where most of the waste is still landfilled (UK > 50% and CEE-countries > 75%), policy and investment programs are focussing on waste incineration as the next step in the European waste hierarchy. The results from a feasibility study might be an incentive to rearrange these programs in favour of the recovery and recycling infrastructure.

A sound feasibility study on the MFL-concept with facts and figures should be able to demonstrate both the ecological benefit and the economic good sense of recycling and resource efficiency. In this way it will function as a policy supporting instrument, which can be forwarded to decision makers in Brussels in order to start discussions with the EU-commission on how to implement this vision into EU-policy. In fact it contributes to a more sustainable society and the ultimate goal of a society without waste.