12th–14th June 2014:
2nd INTERNATIONAL CONFERENCE on
Sustainable Solid Waste Management

Sustainable Municipal Waste Management towards the goal of zero waste

M.C. Samolada[2] and A.A. Zabaniotou[1]

1: Aristotle University of Thessaloniki, Dept. of Chemical Engineering, University Box 455, University Campus, 541 24, Thessaloniki, Greece

[2]: Dept. Secretariat of Environmental and Urban Planning - Decentralized Area Macedonian Thrace, Taki Oikonomidi 1, 54008 Thessaloniki, GREECE

Presentation Contents

- Legislative Frame
- Alternative Waste Management Options
- Selected base scenarios
- SWOT Analysis
- Assessment Methodology
- Results
- Suggestions - proposals

Current Legislative Frame on Waste Management

- **Landfilling Directive** [Dir 1999/31/EU] , to extend their lifetime
- **Wastes Framework Directive** [Dir 2008/98/EC], "waste hierarchy"
- **PR** *(Producer Responsibility)* **European Policy** (Dir 2004/35/EK, Dir 2006/21/EK), the "waste producer" is responsible for its effective and environmental discharge
- **Law 4042/2012** provides definition of wastes and byproducts. MSWs are classified as the "non-hazardous" wastes of the 20th category of the European Catalogue of Wastes (EEL 47/16-2-2001, Directive 2000/532/EK)
- **The "Polluter Pays"** principal (Presidential Decree 148/2009).
- **Ministerial Order 50910/2003**, addressed for the first time the concept of **Integrated Waste Management** (IWM), based on the waste hierarchy principle and the Producers Responsibility (PR) policy

The target is: to boost drastically waste prevention and recycling, as part of the "waste hierarchy". Major emphasis is thus put on recovery and recycling.

In order to boost MSWs recovery and valorization (Law 4042/2012):

Waste codes of the European Catalogue of Wastes (ECW) including

- 20 01 08: Organic kitchen waste
- 20 02 01: Compostable waste
- 20 02 02: soil & stones
- 20 03 01: mixed MSW
- 20 03 02: market wastes
- 20 03 07: bulky waste

will no longer be accepted in landfills after January 1st 2014, without any prior pretreatment and/or recovery.

Otherwise, a gate fee of 35 €/t should be paied
The gate fee rate will be further increased by 5 €/t each next year until a final gate fee limit value of 60 €/t is reached

Waste Management Hierarchy

MSW management via MBT process

MBT is a generic term describing a lot of different MSW process treatment configurations leading to the production of outputs with variable properties. It generally includes process steps for the effective: a) separation - recycling of the recyclable part of wastes, b) aerobic and/or un-aerobic digestion for compost production and c) SRF production via biological drying.

Main configurations include:

- MBT to SRF (SRF: 43 wt %, Byproducts: Recyclables, compost)
- MBT to CLO (Compost Like Output), (CLO, Byproducts: RDF, recyclables, biogas)
- MBT to landfill (Stabilized output, Byproducts: RDF, recylables)

Definitions

- SRF/RDF can be classified as by-product of the MBT in case that they meet certain classification standards , since it can be re-used as commercial certified products or otherwise combusted in an existing production process or a dedicated MSW combustion plant processes
- CLO (Compost Like Product) does not generally meet any certain specifications and its management is particularly a problem. It usually goes to landfills, due to the lack in effective alternative applications. It is expected to have a great potential in the production of “bio-fertilizers”

Representative MSW composition

Textile (+ others): 15.0 *wt %*
Paper : 20.0 *wt %*
Organic fraction : 47.0 *wt %*
Plastic bag : 8.5 *wt %*
Glass : 4.5 *wt %*
Aluminum : 4.5 *wt %*

Current SRF use

- Landfilling
- Combustion (limited)

SRF quantities reaching the amount of 900 ktn/yr are expected to be produced in Greece from the 4 constructed MBT units and

Promising uses have to be proposed in order to avoid their landfilling accompanied with negative economic and environmental impact

SRF classification categories (CEN/TC 343)

Classification Property	**1**	**2**	**3**	**4**	**5**
NCV (MJ/KG), mean	≥25	≥20	≥15	≥10	≥3
Classification Property	**1**	**2**	**3**	**4**	**5**
Cl (d wt %), mean	≤0,2	≤0,6	≤1,0	≤1,5	≤3,0
Classification Property	**1**	**2**	**3**	**4**	**5**
Hg (mg/MJ) median	≤0,02	≤0,03	≤0,08	≤0,15	≤0,50
80th %	≤0,04	≤0,06	≤0,16	≤0,30	≤1,00

Assessment Methodology

The comparative assessment of the 2 scenarios was based on :

•technological and cost aspects

• Environmental Protection and Industrial Ecology/ Symbiosis principles

Alternative SRF valorization scenarios

After following certain standardization it can have interesting applications in:

- *SRF thermal valorization in a dedicated plant*
- *SRF as Alternative Fuel in Cement kilns*

Electricity production is not considered mainly due to the limited units, following strict environmental restrictions. Direct MSW combustion for electricity combustion is more economically attractive.

Application of SWOT analysis leads to

Identification of:

- Strengths
- Weaknesses
- Opportunities
- Threats

In plans and technologies

SWOT analysis concluded that

- *SRF use as an Alternative Fuel in Cement kilns is the most* the *most sustainable and viable valorization process for Greece characterised by an energy efficiency of 73 %.*

The limited capacity of existing cement kilns is the main great obstacle.

- *Application of effective recycling of paper – glass – metals and separate treatment of bio-solids can result in a promising sustainable MSW management.*

Local MBT units of particularly lower capacity and cost will be needed. The produced SRF in lower quantities can find effective application as an alternative solid fuel in the existing cement kilns.

Barriers to the use of SRF as an alternative fuel (I)

The most significant barriers greatly affecting the establishment of a sustainable SRF use include the following aspects:

RBSWM (Regional Body for Solid Wastes Management) participation in the operation of MBT plants, to

- assure for the effective environmental protection
- strengthen the confidence of the public that effective recycling is realized, is the legal responsible for the realization of the approved Regional Waste Management Plan (RWMP)

With the establishment of "corporate social responsibility', RBSWM role is reinforced. The active participation of RBSWM in the operation of the MBT unit, probably by participating in the advisory board could play a drastic role thus strengthening its "responsibility". It could effectively be the connective bridge between the public and the investors and guarantee for a high degree of environmental protection.

Barriers to the use of SRF as an alternative fuel (II)

- **Assurance for effective recycling is very crucial**

It is the main argue of the Green Party in Greece against SRF combustion and/or co-combustion and the base of public scepticism.

The high content of plastics and paper, leads to achieve a high heating and commercial value SRF.

The construction of MBT units without any prior recycling is not an encouraging example towards the European Policy on wastes management

Effective recycling in the source will results in high quality recyclable materials.

It will also increase the MBT process economics, since it will lead in the production of a high quality compost product with increased market opportunities. The higher degree of recycling is beneficial for the treatment processes, since they will become more efficient when they treat a homogeneous MSW stream.

Public's great skepticism/perception

Barriers to the use of SRF as an alternative fuel (III)

Public's great skepticism/perception

Enhance community participation and trust through the promotion of corporate social responsibility. The operation of MBT plants by the RBSWM should increase the public perception and confidence.

Bio- wastes

Bio- wastes *(35 – 40 wt% of MSW)* include the following categories of municipal solid wastes

- 20 01 08 Digestible kitchen wastes
- 20 01 38 Wood wastes not containing toxic/dangerous compounds
- 20 02 01 Garden wastes
- 20 03 02 Market digestible wastes

The Effective collection – valorization of bio-wastes can reduce the MSW and SRF quantities substantially (10 – 40 %)

Suggestions - proposals

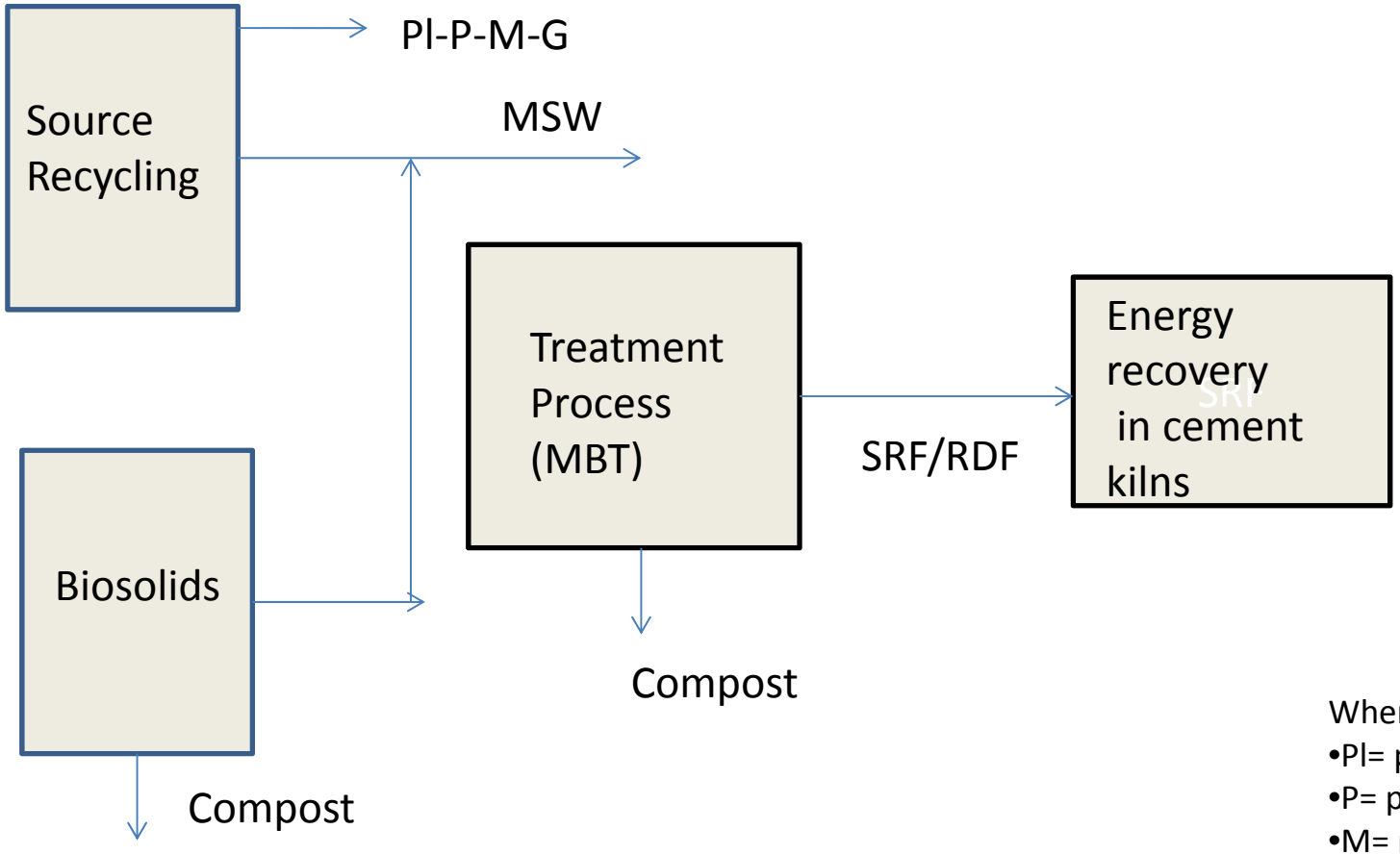
The following stakeholders may effectively participate in a Sustainable Waste Management (SWM) system :

- Industry and Waste Producers
- Commerce units
- Consumers
- Local Authorities
- Industry
- Legislative frame

Each SWM should be

- Environmental friendly (without a controversial environmental impact)
- Safe for the public health
- Economically feasible
- Acceptable from the local community
- Achieve the waste management hierarchy principals
- Localized, by considering the local conditions , and Compatible with local activities.

Proposed Waste Management Scheme



Where:
- Pl= plastics
- P= paper
- M= metals
- G= glass

The effective separation of bio-solids will:

1. Reduce the amount of MSW substantially
2. Reduce the water content of MSW
3. Lead to the effective production of bio-fertilizers
4. Promote the use of SRF in existing cement kilns

Alternative applications of bio-solids include:

1. Production of renewable energy
2. Compost production

Thank you a lot for your attention

and

Sorry for not being present