

Sustainable Municipal Waste Management towards the goal of zero waste

M.C. Samolada² and A.A. Zabaniotou¹

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

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Presenting author email: maria.c.sam@gmail.com, zampani@gmail.com

ABSTRACT

Municipal Solid Waste (MSW) is a complex mixture of various classes of compounds. Major classes include a) textiles, b) paper, c) organics, d) organics, e) plastics) f) glass and g) scrap metals. Representative Greek MSW samples show a particularly high content of organics reaching 47 wt %. The high content of organic compounds, now called bio-solids, greatly affect the acceptable performance of the MSW thermochemical valorization, due to their major share in the water content of MSW.

Towards wastes minimization and recovery, Mechanical – Biological Treatment (MBT) plants were constructed in many European Countries for managing ordinary Municipal Solid Wastes (MSWs). Solid Recovered Fuel (SRF) is the final solid alternative fuel produced in a common MBT to SRF plant . Its effective use and application for energy production is very crucial for the overall process viability. The use of SRF in the cement industry as an alternative solid fuel seems to be a promising valorization approach. The European Cement Industry is open to use a wide range of solid wastes as alternative fuels and materials resource in order to substantially reduce its CO₂ gas emissions. This approach can also lead to substantial savings of fossil fuels - raw materials and zero waste.

In Greece, the successive use of alternative fuels is so far low compared to that in other EU countries as shown due mainly to social reactions. The effective partial or total replacement of common fossil fuels by SRF/RDF for energy and electricity production faces operational and technical problems, mainly related to the toxic and plastic components of MSW.

Following the basic principals of the EU and Greek policy on wastes, this study aims to contribute in the adoption of the effective MSW management and ultimately to investigate the effective use of SRF as an energy resource by analyzing two scenarios: a) The use of SRF in a new combustion unit for electricity production b) The use of SRF as an alternative fuel in an existing cement plant. Finally, suggestions were made for an effective MSW management and valorization with energy and material valorization fulfilling the ‘zero waste’ goal.

The effective and sustainable MSW management is a hot environmental issue and should be treated carefully. The careful selection of the treatment processes is of primary importance both from the economical and the environmental point of view. Energy recovery is the least preferred option based on existing legislation. To this respect, SRF production should be restricted in the production from residual streams resulting after the application of extensive source recycling and composting. The amounts of SRF will be effectively reduced and could be effectively used as a promising alternative fuel in existing cement kilns.

The application of SWOT analysis showed that the use of SRF in cement kilns is more sustainable compared to its use in a new dedicated plant for electricity production.

MSW co-incineration in cement kilns could be considered as the most sustainable and viable valorization process with an energy efficiency of 73 %. SRF produced from biological drying can be effectively used in existing cement kilns, but their limited capacity is a great obstacle.

Application of effective recycling of paper – glass – metals and separate treatment of biosolids can result in a promising sustainable MSW management. This promising approach will result in building local MBT units of particularly lower capacity and cost. The thus produced SRF in adequate quantities can find effective application as an alternative solid fuel in cement kilns.

Biosolids can have further certain applications either in household compost production or in industrial central facilities for the production of compostable materials meeting certain specifications. Sewage sludge and other types of food and agro-industrial wastes can be effectively incorporated in the industrial compost production. To this respect, the goal of zero waste can be effectively attained following a sustainable waste management scheme. Major emphasis is thus put in environmental protection, recycling and re-use, while energy recovery is applied in the final remaining MSW stream. The effective isolation of bio-solids can be achieved only by promoting the household separate collection and will reduce drastically the SRF water content, being a major obstacle in its thermochemical valorization.