Zagreb Municipal Waste Management – Vienna or Naples Model?

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Abstract

Croatian capital Zagreb for the third time is attempting to build Waste-To-Energy (WTE) plant. Zagreb WTE plant is planned to treat thermally residual municipal solid waste (MSW) and sludge from the existing Zagreb waste water treatment plant, and to produce energy from waste. The project has been postponed mainly due to opposition of some environmental organizations.

Experiences of developed countries demonstrate that WTE plants as a rule are integral unavoidable parts of successful municipal waste management systems in the middle and large cities. The main reasons for this are:

- high recycling quotas,
- hygienic aspects,
- mitigation of climate change,
- substitution of imported energy,
- reduction of import dependency and foreign trade deficit,
- organic part of MSW is renewable energy.

Comparison of two completely different models for solution of the MSW problem - cities of Vienna and Naples – clearly indicates which model is more acceptable for the city of Zagreb, as well as for other similar cities.

1 Introduction

With the opening in 1965 of the landfill Jakusevec in the capital of Republic Croatia Zagreb, planning of the Waste-To-Energy (WTE) plant Zagreb started. According to this plan Zagreb WTE plant had to be located close to the existing CHP Zagreb-East through which energy from waste should be delivered to the City's heating and electrical networks. Political disturbances in Croatia at the beginning of 1970's postponed the project. The project was restarted in 1980's on the same site in cooperation with CHP's operator Croatian Power utility, but again it was stopped in 1990's due to the system transition process and war in Croatia. In a meantime the landfill Jakusevec considerably grew, and it became dangerous threat to underground water, air and population, so that its remediation had to be undertaken. At the same time the WTE project was initiated in the year 2000 for the third time, now sited in Ivanja Reka, close to the recently built municipal Waste Water Treatment Plant Zagreb. Zagreb WTE plant should thermally treat

municipal solid waste (MSW) together with sludge from the Waste Water Treatment Plant. WTE construction preparatory activities have been mostly performed, but the project began again to be delayed by actions of some environmental groups, claiming that this project is not necessary because the problem of MSW could be solved only by waste reduction and recycling.

Closing of the landfill Jakusevec is planned after 2010, and the Waste Water Treatment Plant has limited space for temporary disposal of the generated sludge.

Is it possible that city of Zagreb solves its waste problems only by waste reduction and recycling? The answer to this question should be found in the relevant world experiences.

2 World Experiences

The waste problem is highly ranked environmental problem. In the Croatian Environmental protection strategy (1) the waste problem has the highest rank. Although the MSW makes smaller part of a total waste quantity (Figure 1), its role is considerably bigger due to its composition diversity, and because it is related to all citizens.

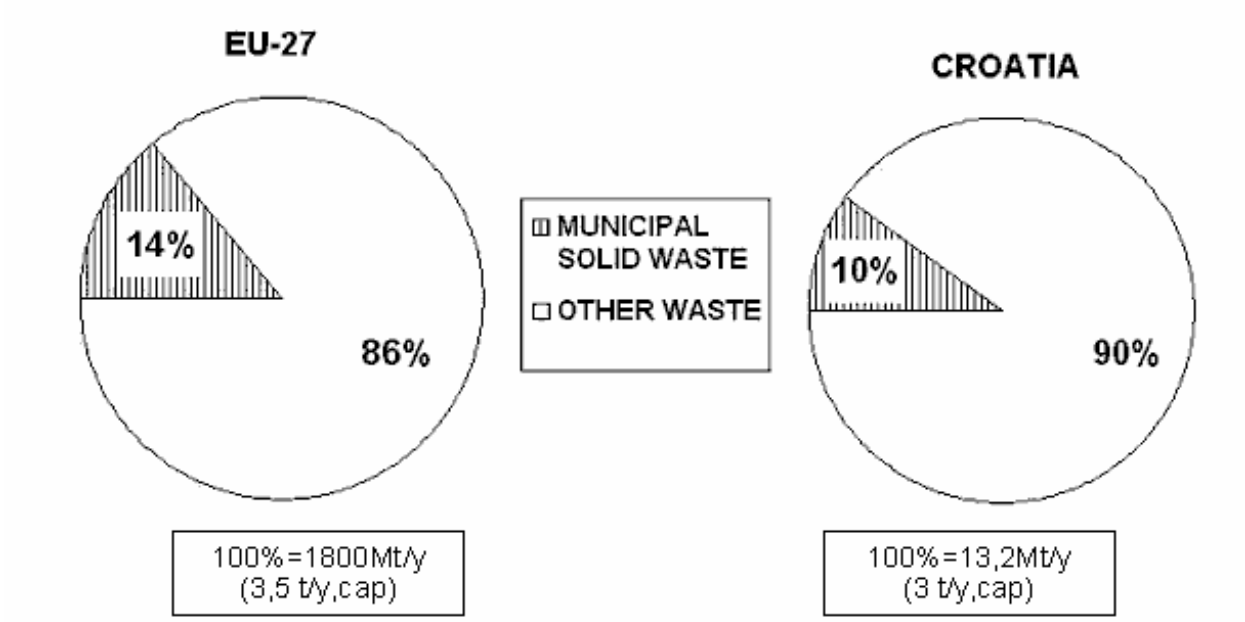

Figure 1 Waste generation 2004 in EU-27 and Croatia

Waste problem is solved by means of modern waste management systems, based on the sustainable waste management concept RUD (Reduction – Utilization – Disposal), which includes number of adequate measures and technologies, from waste generation prevention, over recycling to final disposal.

The objective of such systems is to reduce as much as possible harmful waste impacts on the environment, climate and health together with simultaneous utilization of valuable material and energy properties of the waste.

2.1 Concept RUD

The sustainable waste management concept RUD has been adopted in the city of Zagreb in 1991, and in the Croatia through Waste management strategy 2005 (2). Basic elements of the concept RUD are based on positive world experiences (Figure 2).

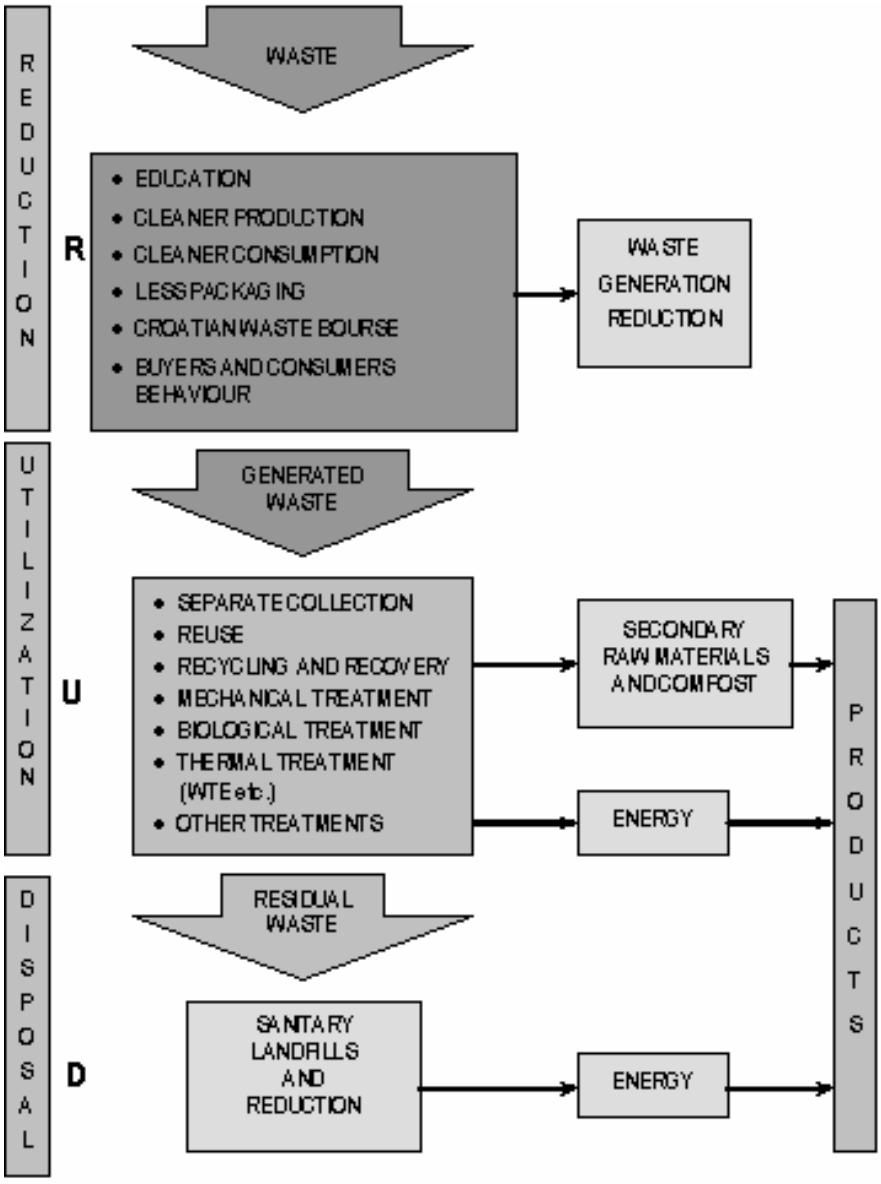

Figure 2 Sustainable waste management concept RUD

The concept RUD is composed of the three hierarchically arranged phases:

- **Waste Reduction R** with objective to reduce waste quantity and harmful properties of the waste as much as possible, so that minimal waste quantity enters the waste management system.
- **Waste Utilization U** with objective to utilize material and energy properties of the waste for generation of the secondary raw materials and energy. This phase begins with waste components separate collection, and includes recycling, composting and waste treatments.
- **Waste Disposal D** on the sanitary landfills (new or remediated existing) has the lowest rank in the waste hierarchy.

Zero waste concept (3) is based on environmentally positive but utopian idea, that waste problem could be solved exclusively by the waste reduction, recycling and composting, without waste thermal treatment and landfills. It is tried to prove general feasibility of this idea in Croatia by means of rare examples of achieved high recycling quotas in the world. Real performances in Croatia and in the world are very distant from this idea, and they have no chance for realization due to economic and social reasons.

2.2 Municipal solid waste (MSW) management

Continuous urban population and living standard increase result in continual growth of the generated MSW in spite of waste generation reduction measures (Figure 3).

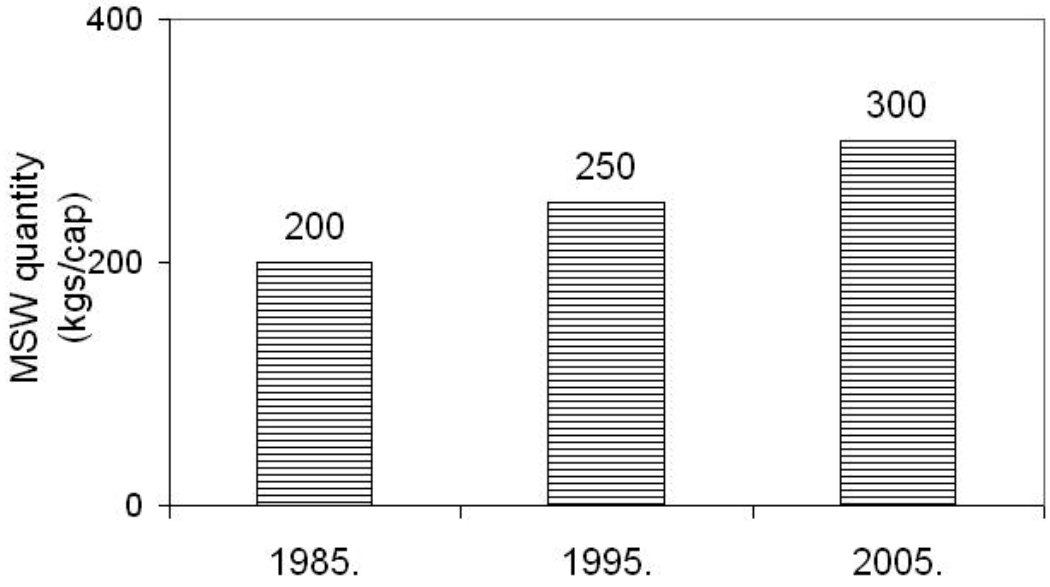

Figure 3 Specific MSW quantity in the world 1985 to 2005

Large differences of MSW generated in various parts of the world are present (Figure 4).

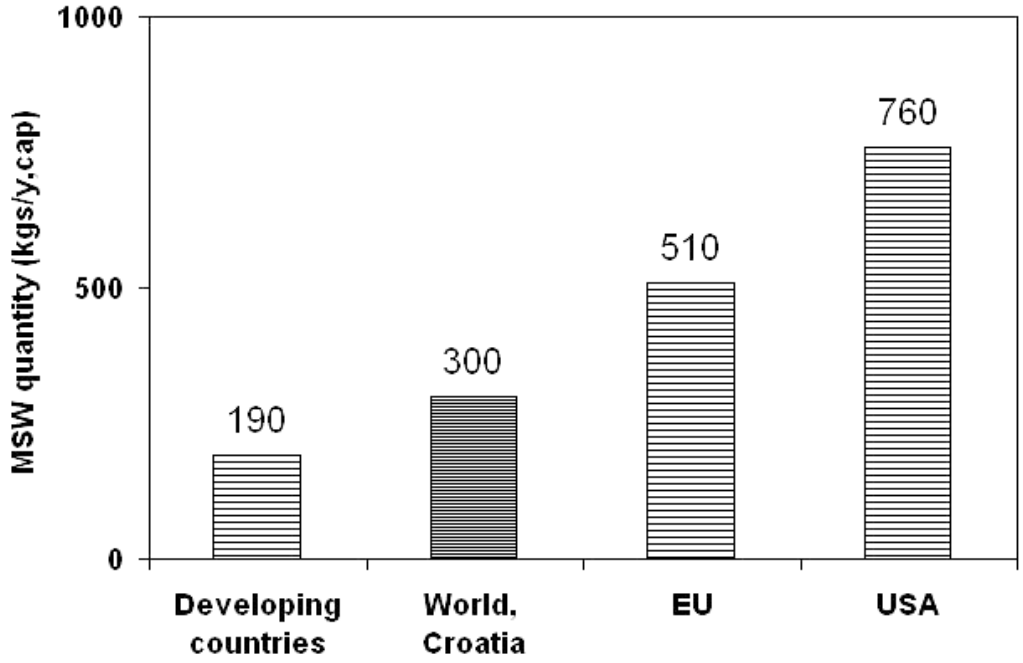

Figure 4 Specific MSW quantity 2005 (EEA, EPA)

Specific MSW quantity per capita in the USA is four times higher than in the developing countries, and about 2.5 times higher than world average. MSW management structures in the EU, USA and Croatia are presented in Figure 5.

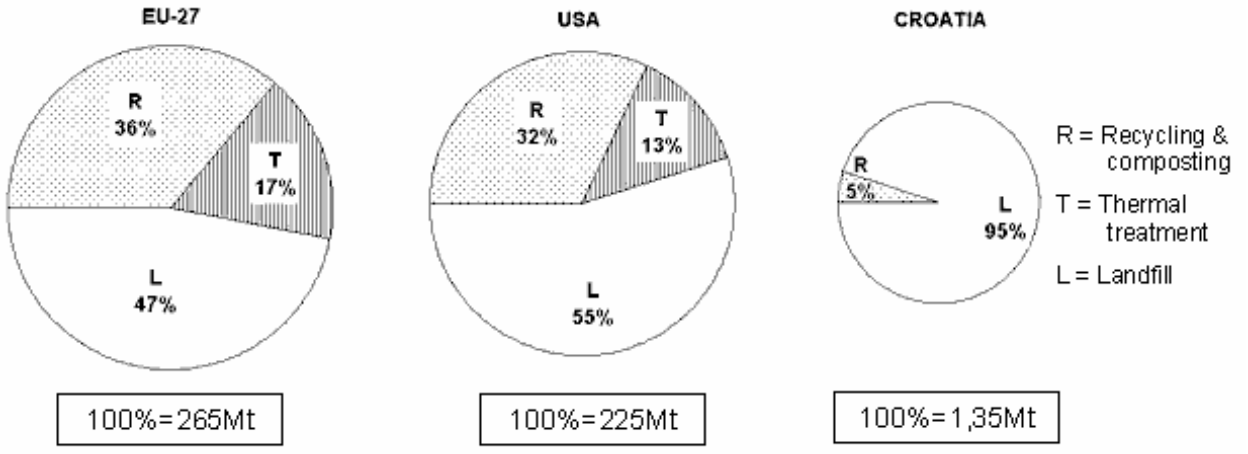

Figure 5 MSW management structure 2005

In spite of great efforts to increase waste recycling and treatment in the most developed parts of the world, approximately one half of the MSW still ends on the landfills.
There are great differences in the MSW management structure between various EU countries (Figure 6).

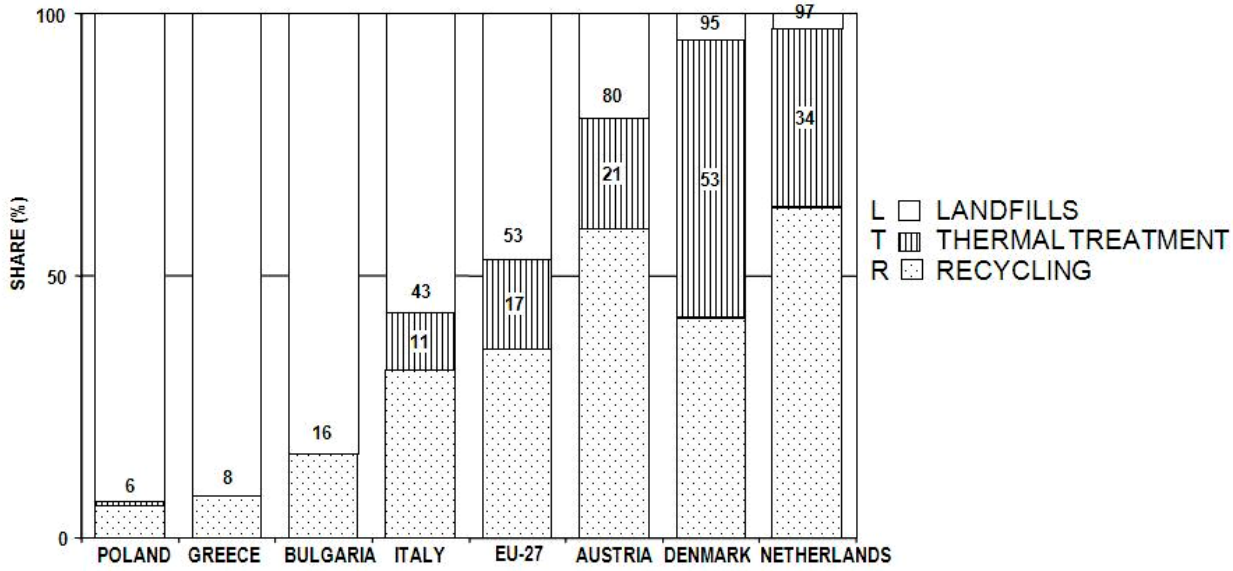

Figure 6 MSW management structure 2005 in EU-27 (4)

The highest share of the MSW was landfill in Poland (94%) and Greece (92%), and the lowest share in Denmark (5%) and Netherlands (3%), due to large differences of the relevant recycling quotas (including composting) and participation of the waste thermal treatment. Recycling quotas have been:

- 5% to 8% in Poland and Greece
- 42 % to 63% in Denmark and Netherlands.

The share of the MSW thermal treatment (WTE) was between 0% in Greece and Bulgaria, and 34% in Netherlands or 53% in Denmark.

Figure 6 also illustrates the fact that high recycling quotas are registered in countries with high shares of the thermal treatment. It means that MSW thermal treatment does not block waste recycling, but contrary to that, it acts stimulating to the recycling. Similar results are registered in the USA, where towns and states with high shares of the MSW thermal treatment simultaneously have large recycling quotas as well.

Recycling potential is frequently overestimated, supposing theoretical potential, which is impossible to realize due to sociological (cooperation of the population), technical (complexity and waste components quality), and economic (saleability of secondary raw materials and costs) limitations.

2.3 MSW thermal treatment

MSW thermal treatment is available in different forms:

- WTE cogeneration plants produce energy from waste (EfW)

- Co-combustion of refuse derived waste (RDF) with fossil fuels in the industrial plants (cementworks, ironworks, etc.) and thermal power plants
- Landfill gas cogeneration plants
- Waste incineration plants are combusting MSW without energy recovery, applicable only for hazardous waste

WTE cogeneration plant functions similar to district or industrial cogeneration plant, combusting MSW instead of fossil fuels. First MSW incineration plants have been constructed more than 130 years ago in the United Kingdom (Nottingham 1874). Since then MSW thermal treatment technology has been continuously developed and improved. Today, there are about 1000 WTE plants in the world, with more than 400 in Europe.

- MSW WTE plants are important element of the modern waste management systems due to the following reasons:
- WTE plant has high MSW recycling quota of approximately 70%, transforming waste to energy, respectively 95% when combustion residuals (slag, iron) are utilized.
- MSW thermal treatment is the most hygienic waste disposal technology because it destroys all pathogen elements (bacteria, viruses).
- Generation of energy from waste is increasingly interesting due to high growth and instability of the fossil fuels prices, and due to the mitigation of climate change (organic part of MSW is renewable energy).
- MSW thermal treatment considerably reduces landfills surfaces.
- Energy from waste reduces energy imports and related foreign trade deficit.

3 Story of waste from two towns

MSW problems are more complex in larger towns, and for their solution increasingly complex waste management systems are required.

Two completely different models for the MSW problem solution represent the towns:

- Vienna (Austria) as a successful model, and
- Naples as an unsuccessful model.

3.1 Vienna MSW

Austrian capital Vienna with population of about 1,6 millions has an integrated MSW management system, whose structure is presented in the Figure 7.

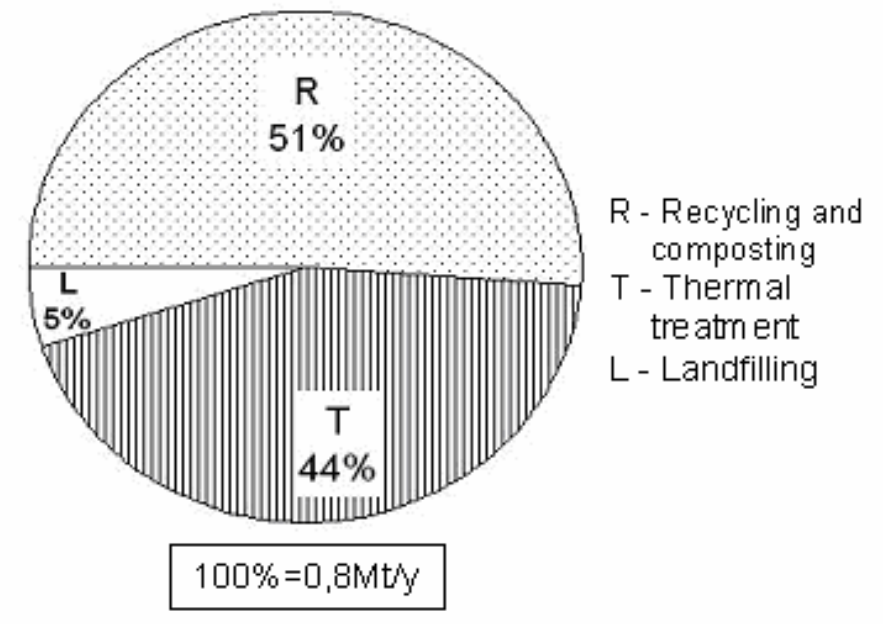

Figure 7 Vienna MSW management structure (6)

Thanks to high share of the MSW thermal treatment, recycling and composting only about 5% of untreated MSW is disposed off on the landfill Rautenweg, whose closure is planned after the year 2020.

Integrated MSW system includes four WTE plants (Table 1) and ABA Rinter AG waste management center for about 450000 tons yearly, with different MSW plants.

Table 1 Vienna WTE plants (6)

WTE plant	OPERATION START	CAPACITY(t/y)		
		MSW	Sludge	Hazardous waste
Flötzersteig	1963	200 000	-	-
Spittelau	1971	260 000	-	-
Simmeringer Haide	1980	100 000	200 000	100 000
Pfaffenau	2008	250 000	-	-
TOTAL	**-**	**810 000**	**200 000**	**100 000**

All WTE plants are in the scope of District heating Vienna (Fernwärme Wien) producing about 22% of heating energy from 60% of Vienna's MSW.

The fire in 1987 damaged significant part of the WTE Spittelau, located close to the Vienna center. After this accident the plant was restored according to the project of the well-known architect Hundertwasser, becoming one of the Vienna symbols (Figure 8).

Figure 8 WTE plant Spittelau Vienna

All emissions of the WTE plants in Vienna are controlled and kept well below permitted limits.

Vienna waste management system represents good model for many towns all around the world, thanks to its positive environmental, climate, economic and sociological results.

3.2 Naples MSW (7)

Waste crisis in the city of Naples (population about one million), one of the Italian tourist pearls, is lasting more than 10 years. The crisis culminated in the season 2007/8, when the police and army had to intervene and the new Italian government of Mr. S. Berlusconi had the first session just in Naples.

Naples landfills were closed due to the overfilling, and the attempts to reopen them were blocked by the nearby population. For some time the MSW has been transported to the neighboring Italian regions, but soon it was banned. The MSW was then exported to some European towns (Hamburg, etc.) with rather high costs. All this was insufficient,

so that at the beginning of the year 2008 MSW started to accumulate on the Naples streets, and the embittered citizens put the fires, conflicting with the police (Figure 9).

Figure 9 Waste crisis in Naples

The main reasons of the "waste Crisis" in Naples are the following:

- Unrealized waste management plans with several WTE plants and landfills, mainly due to resistance of environmental organizations and local population.
- Low waste recycling quotas, less than 10% (the lowest in Italy).
- Considerable influence of the criminal organization Camora, which many years realized large profits (more than one billion € yearly) by illegal landfilling of hazardous wastes from other Italian regions.

Among other negative effects due to the waste crisis, Naples with surrounding was proclaimed in medical circles as "death triangle" because of increased mortality from cancers and genetic deformation of the nervous and urinary systems.

New Italian government undertook urgent measures to mitigate "waste crisis" in Naples and the region Campania:

- Ex-police chief was nominated as commissioner for the Naples waste.

- Construction of three WTE plants in Naples and Campania was mandated in the next three years.
- Increase of waste separate collection and recycling.
- Preparation of the waste management strategy in accordance with EU regulation.

4 Conclusion

During last forty odd years the capital of Croatia Zagreb is trying to build Waste-To-Energy (WTE) plant. Two attempts in the 1970's and 1990's failed mainly due to political reasons. The landfill Jakusevec close to the river Sava grew considerably, endangering ground waters, environment and surrounding population, so that it had to be costly remediated. Third attempt to build WTE plant Zagreb is under way, this time with objective to treat thermally the MSW and the sludge from the existing Waste water treatment plant Zagreb. This attempt is exposed to strong opposition of some environmental groups, which intend to impose unrealistic "zero waste" concept, namely that waste problem in Zagreb should be solved exclusively by waste reduction and recycling without "dangerous" WTE plant.

However world experiences demonstrate that waste problem in more developed parts of the world is solved as a rule by means of the modern waste management concept RUD (Reduction – Utilization – Disposal) with many elements, including recycling, composting and WTE plants,

Comparing two extremely different waste management models – Vienna model with all elements of the modern waste management system, including four WTE plants, and Naples model without these elements, which entered serious "waste crisis" – it is not difficult to conclude which model would be more appropriate to the city of Zagreb.

This is no doubt Vienna model, adjusted to local conditions and possibilities.

5 Literature

NN	2002	National environmental protection strategy, 46/2002
NN	2005	Croatian waste management strategy, 130/2005
NN	2007	Zero Waste, Waste Management Handbook, Green Action, Zagreb, 11.2007
EEA	2007	The road from landfill to recycling, common destination, different routes
Potocnik, V.	1997	MSW treatment – world experiences, Zagreb

NN	2007	8th International Conference on Waste Management, Vienna, 11.2007
NN		Naples waste management issue, www.wikipedia.org