

SUSTAINABLE WASTE MANAGEMENT: EUROPEAN EXPERIENCES - CROATIAN PERSPECTIVES

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Abstract

Large amounts of waste have caused the EU member states to launch legislative framework on waste management. During last decades those regulations have been changed and amended in accordance with changes in the environment and needs for action.

Introduction of the new framework and new aims stressing the prevention of waste creation led to the reform and simplification of the European waste management policy, which is the trend of developments in waste management.

Through the Waste Management Strategy and Waste Management Plan 2007-2015, Croatia chose a concept of county and regional waste management centres. Due to the difference in quality, but also in environmental acceptability of particular procedures of waste processing, hierarchical sequence of waste disposal includes waste creation prevention, reuse, recycling and composting, energy recycling and other kinds of processing before final disposal of the remaining waste.

Croatia plans establishment of an integrated waste management system by the end of 2018. The accent is on decreasing of disposal and increasing of recycling by means of the establishment of primary selection, recovery of the existing waste disposal sites as well as construction of waste management centres.

The integrated waste management system plans recovery and closure of all disposal sites and establishment of waste management centres by the end of 2018, and recycling of a minimum of 50% of glass, paper, plastic and metal by 2020.

Public sector and other institutions have shown great willingness to implement the set tasks and goals on national, regional and local levels including the challenges accompanying possible lack of vertical and horizontal communication and coordination.

Keywords: *waste disposal, recycling, waste disposal sites recovery, public institutions, communication, coordination*

1. The European Union's approach to waste management

According to analysis of waste quantity in Europe from the 16 tonnes of material per person per year approximately 6 tonnes become waste. Precisely, 492 kg of municipal waste was generated per person in 2012, while 480 kg of municipal waste was treated per person in the EU 28. One of the main features of waste management is moving towards "a society that recycles its waste," and in addition seeks to produce less waste and use it as a resource.

The Waste Framework Directive defines waste categories as: municipal waste, hazardous waste, non-hazardous waste and inert waste. 50% of waste materials from households and from sources that are similar to households are to be prepared for reuse and recycling, and 70% of construction waste are to be prepared for re-use, recycling and other recovery procedures until 2020, according to Waste Framework Directive. (Directive 2008/98/EC on waste, <http://ec.europa.eu/environment/waste/framework/>)

There is a noticeable difference in the amount of produced waste among EU member states. For instance, in 2012 Denmark was the leading country with regard to the amount of waste produced, with 668 kg, followed by Cyprus, Luxembourg and Germany with the quantities of waste generated per person less than Denmark, but still above 600 kg, and Malta, Ireland Austria, the Netherlands, France, Italy, Finland and Greece with an amount between 500 and 600 kg. The United Kingdom, Lithuania, Spain, Sweden, Bulgaria, Belgium, Portugal and Hungary have created between 400 and 500 kg of waste per capita, while values below 400 kg were recorded in Croatia, Romania, Slovenia, Slovakia, Poland, Czech Republic, Latvia and Estonia. (Eurostat news releases, Environment in the EU28 http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/8-25032014-AP/EN/8-25032014-AP-EN.PDF)

Higher levels of consumption in highly developed countries entail the production of larger quantities of waste per capita. Table 1 compares the average recycling rate for the period from 2010 to 2012 of the EU 28 and the three countries the highest rates of recycling during this period.

Table 1 The average recycling rate for the period from 2010 to 2012 (EU28, Germany, Austria, Belgium)

	Recycling rate, %		
	2010	2011	2012
EU 28	38.1	39.5	41.3
Germany	62.5	63.0	64.5
Austria	59.4	59.4	59.4
Belgium	57.8	57.7	57.3

Source: Eurostat news releases, Environment in the EU28.

http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/8-25032014-AP/EN/8-25032014-AP-EN.PDF
Accessed on 24.10.2014.

The Waste Framework Directive defines obligations for recycling and renewal of a growing portion of the waste in the Member States of the EU. Thus, the amount of recycled waste increased by 15% in the period from 2004 to 2009.

Priorities in the relationship towards waste management result from the hierarchy in taking the choice of methods for dealing with waste in precise order such as prevention as a starting point, preparing for reuse as a next step, followed by recycling, then using other recovery methods and ending with disposal.

The Article 29 (2008/98/EC) sets the period of at least six years to evaluate the waste prevention programmes. The waste prevention objectives are to be clearly recognized through established programmes. Furthermore, existing prevention measures should be described in detail as well as indicators for their evaluation. These objectives and measures should have influence on reducing generation of waste related to economic growth and environmental impacts.

2. Lessons learned - various initiatives to reduce the generation of waste

The environmental hazards have greater socioeconomic and eco-efficiency impacts due to global population growth rate, to the continued economic growth, and comprehensive communication systems.

As examples of the initiatives to reduce the generation of waste we have chosen countries such as Italy, Switzerland, Austria, the Netherlands, Portugal, Spain and Great Britain.

In order to allow customers to purchase the desired amount of goods, and to simultaneously reduce the packaging, dry food is sold in bulk as is the case in Italy and Switzerland. It is good for the environment and saves the buyer's money - between 10 and 70% compared to the price of packaged goods. Such an initiative prevents the use of about 1 mln packs per year in Italy and in Switzerland.

In recent years, Comune Ponte nelle Alpi, Veneto Region, is the leader of positive change in the separate collection (recycling) that is implemented in the whole Italy. Since 2007, when only 23% of waste was separately collected, this figure had risen to 90% of waste collected today.

In 2007, Municipality of Ponte nelle Alpi committed itself to reduce the amount of waste generated and waste disposal costs, so they introduced charging on the principle "the more you separate, the less you pay" on one side. On the other, they also introduced a collection system "door to door" for all types of waste, in such a way representing a significant milestone in the waste disposal system.

In Rome, it is annually produced about 1.8 million tons of waste, but only 31.1% or 545,000 tonnes is classified. Every inhabitant of Rome daily "produces" 1.6 kg of waste, but only one third of that quantity can be classified and put in cans for a particular type. On average, each inhabitant of Rome annually pays about 90 Euros

for the disposal of their garbage, or a family that numbers four persons pays 360 Euros a year.

Austria and the Netherlands are leading countries in Europe in successful waste management and they act as an example to other European and world wide countries. In Austria less than one percent of untreated municipal waste is deposited. In Vienna, about 27 tons of glass, 15,000 tonnes of waste paper and 5,000 tons of plastic bottles is collected annually. The recycling of plastic bottles per year saves nearly 10,000 tons of oil in the production of new bottles. Furthermore, by recycling of glass it saves over 250,000 tonnes of primary raw materials, such as quartz sand, limestone and soda, which is required for the manufacture of glass. When it comes to the old metal, the total annual amount collected in Vienna could be used to produce 1.6 million new bikes.

In Portugal, there is a project called "Right Size Menu" which supports restaurants in compiling a menu that influences smaller production of food waste. Waste management organizations from Porto Lipor aims to reduce the waste of food by 48.5 kg per year per restaurant. This will be achieved by changing behaviours and attitudes about food, by encouraging restaurants to reduce portion of meals and by serving balanced meals.

The project "Technology for Recycling" from Spain, financed from the EU funds, focused on the collection and recycling of plastic bottles of pesticides by use of an advanced oxidation process driven by solar energy to protect the environment. The total project value was € 1.5 million, and the EU funding amounts to € 676,988.

In the UK there is a program which takes a role in creating a market that connects providers and customers of waste through the establishment of operations that convert waste into electricity, bio-fuels or similar.

3. Waste - a hot topic in Croatia again

In 2014 the waste management system in Croatia is a topical issue again. Croatian accession to the European Union has accelerated the activities to establish a waste management system, as well as the preparation for the construction of regional waste management centers. It has also accelerated activities to create the infrastructure requirements for separate waste collection in the cities and municipalities.

Smart waste management is one of the most important environmental factors, and thus figures as an important part of the sustainable development of a region. Therefore, it is a key problem that must be urgently and consistently addressed. Uncontrolled, inappropriate and illegal dumping of waste is a constant threat to water, soil and air pollution and as such acts as the significant risk for human and animal health, especially due to the direct contact with living beings while indirect threats are contaminated substances.

Despite the new initiatives, the existing legal framework in line with the *acquis communautaire*, and the existence of strategic documents and plans, a slight increase in the total amount of municipal waste is still evident. In 2012, only 16% of collected waste was recycled in Croatia, which is much less than the European average of 42%. It was planned to complete remediation and closure of official landfills by the end of 2012, but unfortunately there have been delays in the implementation and construction of regional waste management centers.

However, examples of good practice can be seen in the separation of 40% of the waste on the island of Krk and the town of Čakovec. In addition, the town of Čakovec began with the introduction of waste separation bins for separate collection in every household.

The Act on sustainable waste management (OG 94/13) establishes measures to prevent or to reduce the harmful effects of waste on human health and on the environment by reducing the amount of waste in the creation and / or production and by regulating waste management without the high-risk procedures to human health and the environment and with the use of valuable waste. The regulations of this Law establishes the waste management system, including the order of priority of waste management, principles, objectives and methods of waste management, strategic and program documents in waste management, responsibilities and obligations in waste management, location and waste management facilities, transboundary movements of waste, waste management information system and administrative and inspection supervision of waste management.

Waste Management Strategy of the Republic of Croatia (Official Gazette No. 135/07) and the Waste Management Plan (Official Gazette 85/07, 126/10, 31/11) are the main documents on waste management in the Republic of Croatia for the period 2007 - 2015, but they are currently in the finishing phase as they have to be in compliance with the existing framework and the new guidelines contained in the 7 Action Programme for environmental protection of the EU.

Effective waste management is a complex process that requires the concerted action of public administration, regional and local governments, scientists, experts, associations, business people, the media, the local population and the general public. Furthermore, it requires the citizens' rights to have a healthy environment, correct timely information, participation in decision making and access to justice. It will be easier to answer the challenge if everyone (citizens, public) is trained and encouraged to participate in decision-making regarding the waste management.

3.1. The financial framework for implementing the changes in waste management

By the end of 2018, it is planned to build 13 centers for waste management and to introduce a system of separate collection and recycling of at least 50% of glass, paper and plastics. The fulfilment of these procedures would make possible the establishment of an integrated waste management system. Among nearly HRK 5

billion allocated for the construction of waste management centers in Croatia, HRK 3.5 billion or approximately 65% are non-refundable EU funds.

In addition to the planned investments, significant projects in water supply, transport, strengthening the competitiveness of businesses, improvement of business infrastructure and in other areas have been contracted or are being negotiated.

Among the 13 planned waste management centers, the first two are nearing completion. For five of them, documentation for EU funds has been prepared, while tenders for the remaining six are to be realized by the end of 2015.

From the EUR 6.8 billion from the Operational Programme Competitiveness and Cohesion 2014-2020 more than EUR 2.7 billion have been allocated to the five priorities for competitiveness: research and innovation, information and communication technologies, the development of small and medium enterprises, low-carbon economy, and education (see Table 2). Over 45 percent of the total allocation of the European Regional Development Fund will be used to support small and medium-sized enterprises, research and innovation. The high share of investment, more than EUR 3.5 billion, Croatia will invest in environmental protection, climate change adaptation and traffic.

Priority Axis	Priority	The specific objective	Financial allocation (EUR thousand)	Source of funding
Environmental protection, adaptation to climate change and sustainability of resources	The investment in the waste sector to meet the requirements of the <i>acquis</i> of the EU in the field of environment and meet the demands set by the Member States for investment that exceeds these requirements	The development of waste management infrastructure with the aim of establishing an integrated waste management system and reducing the risks associated with waste	450,000	Cohesion Fund
		Improving waste management system in order to increase separate collection and recycling / recovery	50,000	Cohesion Fund

Source: Republic of Croatia OP Competitiveness and Cohesion 2014-2020 (Draft)

An example of a good practice is the project "Sound wall made of recycled rubber" whose goal was to build innovative wall made of recycled rubber to protect the Zoo. EU co-financing amounted to €650,000. The project leader is the Faculty of Construction in Zagreb.

The projects financed from the EU funds (FP7, EUREKA, LIFE,...) stored in the database of the University of Zagreb, include also projects with waste management topics. In most cases, the partners in the project are Croatian faculties. Some of the

projects are: “Reduction of environmental risks, posed by emerging contaminants, through advanced treatment of municipal and industrial wastes” by Faculty of Food Technology and Biotechnology; “Sustainable measures for Industrial Laundry Expansion Strategies: SMART LAUNDRY-2015” by Faculty of Textile Technology; “Biotechnological conversion of carbon containing wastes for eco-efficient production of high added value products” by Faculty of Food Technology and Biotechnology; “Reduction of environmental risks, posed by emerging contaminants, through advanced treatment of municipal and industrial wastes” by Faculty of Chemical Engineering and Technology; “Development of sustainable construction and demolition waste management system for Croatia” by Faculty of Civil Engineering; “Development of sustainable construction and demolition waste management system for Croatia” by Faculty of Civil Engineering, etc.

4. Discussion

A comprehensive waste management system should be introduced in Croatia by the end of 2018. Procedures, like reducing delays and increasing the recycling of waste, are regulated by the Act on sustainable waste management (Official Gazette 94/13), and this will be facilitated by the introduction of primary selection, then remediation of the existing waste landfills, and by the construction of waste management centers. From 24 July 2014 citizens should have been provided with the classification of the seven reusable components of waste: paper, metal, glass, plastics, textiles, dangerous waste and bulky waste due to the regulations in the Act on sustainable waste management.

Those waste producers who are responsible for more than 150 tons of non-hazardous waste and /or more than 200 kilograms of hazardous waste should have the Waste Management Plan. Such a Plan has to be prepared for the four-year period. One copy must be submitted to the competent administrative body in the particular county and to the Environmental Protection Agency. Until 2015 the obligation of cities and municipalities are to provide separate collection of waste, while closing unmanaged landfills has to be done by the end of 2017. The obligation to establish a waste management centers has to be fulfilled until 2018, and by 2020 commitments have to be made to assist the preparation for reuse and recycling of waste, of at least 50% of the total weight of waste. (Waste Act (Official Gazette no. 178/04, 111/06, 60/08, 87/09))

The implementation of the Waste Act has to be monitored through controlling the amount of waste deposited in landfills. Recycling can be increased to a minimum of 50% by 2020, for the components such as paper, glass, plastic and metal, by use of separate collection, reuse and recycling. Due to separate collection, cities and municipalities are obliged to provide the green islands, recycling centers and, most importantly, they have to allow the waste separation at the doorstep. According to the Inspectorate, the latest data show that 71.6% of them started with the primary

selection, while in the 2012 only 39.5% of local governments have some form of primary selection.

5. Conclusion

Considering the environmental legislation in Croatia so far, we can say that it has been reactive and focused on waste treatment lacking the care for resources. In the process of complying with European legislation, Croatia will make a shift towards a proactive and preventive approach to the environmental protection and savings of resources.

In Croatia, counties, cities and municipalities are required to adopt waste management plans for the period of eight years. Waste management plans by cities and municipalities must be consistent with the plans of a higher order and environmental programs. There is also an obligation of submitting annual reports on the implementation of the plan.

Challenges in managing the waste in a proper way are highlighted with Croatian accession to the European Union. Croatia accepted all the requirements set by the Union. It is necessary to strengthen the effective horizontal cooperation between local governments and vertical cooperation between different levels of authorities (between local and regional levels, as well as the national level where useful). Also, it is necessary to provide the financing for the expensive infrastructure for sustainable waste management, then to monitor and to control the implementation of sustainable waste management, to ensure the transparency, to educate population and to include public participation.

Reasonable and responsible waste management will provide much more eco-efficiency with a guarantee of social development in accordance with sustainable development.

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