

The European Energy from Waste Market – Status and Perspectives

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1. Legal framework

Environmental protection has become an important priority in the European Union. Almost all of the environmental sectors are covered by the European Community Policy and related Community legislation. This also applies to the waste sector. Again, the EU is affecting here the Member States increasingly more and has provided in recent years for decisive steps that have been taken towards the further development of European waste management and the implementation of new technologies and concepts.

The legal framework for the European waste management constitutes the EU Waste Framework Directive (WFD). In addition, important regulations are anchored for the sector of waste treatment, such as the EU Waste Shipment Regulation, EU Directive on Packaging Waste, EU Landfill Directive, EU Waste Incineration Directive, and EU Combined Heat and Power Policy Directive.

In accordance with the Landfill Directive, the EU Member States have an obligation to prevent the production of methane gas from landfills, making therewith a contribution to climate protection. Therefore, the Directive requires a significant reduction in the deposition of organic waste. Based on the year 1995, the deposit of biodegradable municipal waste is to be reduced by the year 2006 by 25 per cent, by the year 2009 by 50 per cent, and by the year 2016 by 65 per cent. Moreover, a general pre-treatment regulation (ban on dumping of untreated municipal waste) is in force.

Since December 2005, the amendment of the EU Waste Framework Directive has been discussed and adopted in the year 2008 by a legislative resolution of the European Parliament. The revised version of the Waste Framework Directive has, inter alia, become necessary in order to clarify the definition of key terms, such as waste, recycling, and disposal, and to strengthen measures for waste recycling.

Due to the amendment, a new waste hierarchy in the following order

- Prevention and Reduction,
- Reuse,
- Recycling,
- Other recovery operations,
- Environmentally sound disposal

came into force. Waste prevention, reuse, and recycling obtained, due to the new 5-level hierarchy, particular importance. This hierarchy is to be understood as a flexible *guiding principle*, i.e. as a principle as such. Deviations are allowed if clear benefits can be proven for humans and the environment. The responsibility of the producers of the whole waste hierarchy has been committed. In addition, binding definitions have been created for the distinction between waste, by-products, and end-of-waste property.

Waste prevention programmes enjoy the top priority. Member States may adopt measures in order to transfer to the manufacturers of products an expanded responsibility for the prevention, recycling, or other disposal of waste. These include, for example, the withdrawal of products, the development of reusable or long-lived products, and the development of easily recyclable products. Member States should draw up by the end of the year 2013 waste prevention programmes, in which they should set their waste prevention objectives and measures.

Member States should take, according to the further order of the waste hierarchy, measures to promote high quality recycling from the waste arisings. By 2015, the separate collection of paper, metal, plastics, and glass should be introduced in all the Member States, and by the end of the year 2020 they should reach certain recycling rates (50 % for paper, metal, plastics, glass, and 70 % for construction and demolition waste). The separate collection of organic waste for the purpose of composting and anaerobic digestion also should be encouraged by the Member States. Recovery operations include e.g., in addition to the material recycling, also the processes of thermal recycling effective as a fuel. The differentiation between energy recovery and disposal of residual waste, disputed for a long time, has been finally clearly defined. In terms of the necessary resource efficiency, the replacement of raw materials or fuels by waste will in future be the key standard. The thermal waste treatment plants also can be recognised as energy recovery systems – but only if they provide good energy for use. As a standard, the R1 Criterion was, therefore, defined: New plants should demonstrate a value of 0.65, old plants should reach a value of 0.60.

The principles of self-sufficiency and proximity concerning the disposal of waste, which already have been valid so far for the disposal of residual waste, were extended to the recycling of mixed municipal waste. In the wake of the ban on dumping of untreated municipal waste, these principles still imply in many European countries the creation of additional treatment capacities. The amended EU Waste Framework Directive also amplifies the EU Waste Shipment Regulation in a sense that a member country may restrict the import of waste if national waste amounts could be thereby displaced by low-cost disposal/treatment options.

Altogether, the amended EU Waste Framework Directive and other relevant European frameworks for the development of the business model *energy from waste* ensure a favourable business environment.

2. Status Quo

The state of waste management in the European countries is moving differently at different levels. With its legal framework, the EU exerts the pressure to act on the competent authorities in the Member States. In some countries (Germany, the Netherlands, Belgium, Austria, Luxembourg, and Denmark), already before the European initiatives, waste management laws had been adopted; their goal was to prevent waste, utilise it, address environmental regulations by its treatment and, therefore, to terminate the deposition of untreated waste. Other countries (e.g. UK, France, Ireland, Portugal, Spain, Italy, and Greece) with particularly quite high landfill rates have just started this process or have currently been demanded that they fully implement the Union's waste policy at the national level.

A strong development need is particularly valid for waste management in the newer Member States of the EU, which still are dumping between 70 and 100 per cent of the waste. Transition periods for the implementation of the European ban on the dumping of untreated municipal waste have been defined. Efforts to implement the European waste policy can be recognised particularly in Poland, the Czech Republic, Latvia, Slovakia, Slovenia, Hungary, and Estonia. Collection and recycling systems have been, or will be, introduced. However, there is a lack of waste treatment facilities for residual waste that are compliant with the European standards. The landfills, still existing in large numbers, must be closed, or – if still needed – also upgraded to the European standards compliance level. The accession treaties with new Member States provide that the environment standards there will be the same in the foreseeable future as those in the old Member States. The EU funds under the Operational Programme *Environment*, inter alia, also the improvement and development of the waste management infrastructure in new EU Member States. Such projects initially focus on the upgrading of existing landfills, introduction of separate collection systems, development of (pre)treatment capacities (composting, sorting, recycling), as well as the strengthening of respective public administration structures.

The EU has already put in the current budget period at the disposal of the new Member States (e.g. Poland) funds in order to provide subsidies for thermal treatment facilities, too. Further funds are expected in the budget period starting from 2014. Moreover, transformation processes and respective investments in the waste treatment infrastructure are also supported by the European Investment Bank.

3. Waste arisings

Waste generation is influenced by various factors. Economic growth, demographic change, technological progress, and consumer behaviour are just a few, but important, factors. The past has shown that waste generation is linked in particular with the population and the development of national economies, as measured by the gross domestic product. In terms of these two indices, the following is predicted [1]:

The population in the New EU-12 countries is expected to decrease by 5 million and increase by 13 million in the EU-15 countries during the period 2005 to 2020. The total population in the EU-27 was 483.5 million in 2000, 492.8 million in 2010 and is expected to be increase to 498.8 in 2030.

Looking into country specific details the demographic assumptions are different: Whilst the population in Germany is going to decrease by 2 million between 2010 and 2015 with a further decrease by 8 million until 2050 the situation in the UK is completely the opposite. The assumptions show an expected increase of the population by 9 million during the period 2010 to 2050.

The differences in development between the old and new EU Member States are also reflected in the projected development of the country's gross domestic product. While for the old Member States, an annual increase of 2.0 per cent is predicted between the years 2005-2020, but the economic development of the new Member States will proceed more rapidly. For these countries, an annual increase of 4.1 per cent is predicted for the same period.

According to these indices, the actual forecasts are based on a growing volume of total municipal waste.

The generation of municipal waste was projected to be 290 million tonnes in the EU-27 in 2010 with a further growth to 336 million tonnes in 2020. Approximately 80 % of this waste will be generated in the EU-15. Waste generation per inhabitant has been increased during the last years, latest projections show a further increase until 2020. In 1995 the EU-27 countries generated 460 kg waste per person, this grew up to 520 kg per person in 2004. Assumptions show that this will increase to 680 kg per person [1].

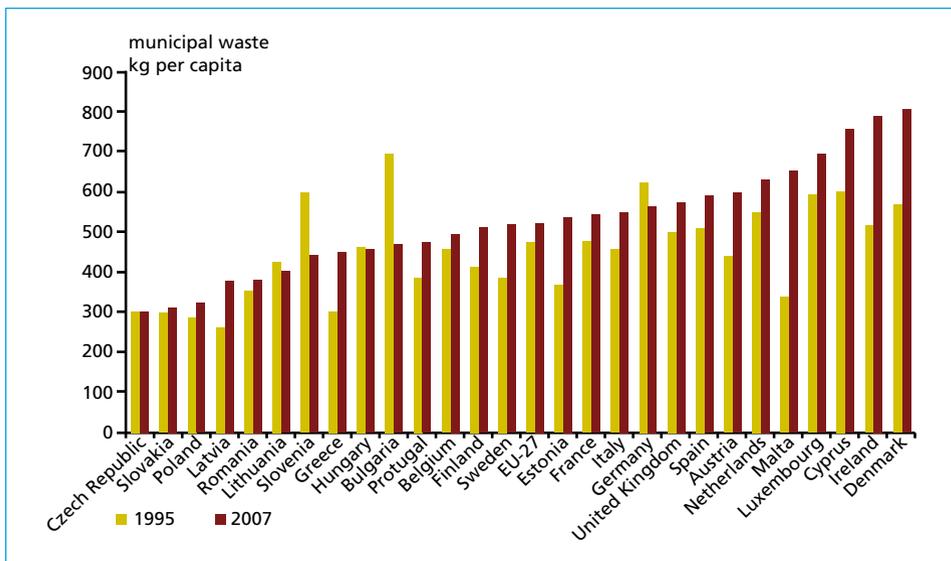


Figure 1: Generation of municipal waste in the EU-27, 1995 and 2007

Source: Diverting waste from landfill. Effectiveness of waste-management policies in the European Union. EEA (European Environment Agency) report, No 7/2009

There are considerable differences amongst Member States. The annual generation per person varies from 306 kg in Czech Republic to 453 kg in Greece and up to 802 kg in Denmark. Some countries have achieved a stabilisation of waste generation or even a reduction while others follow a constant increase. Summarising figure 1 the waste generation per person in the EU-12 was lower than in the EU-15 countries.

If it is assumed that the predictions are correct, the waste amount in the old EU Member States would increase in the years 2005-2020 by approx. 22 per cent (see Figure 2). The growth rates of individual countries are very different. For the Netherlands, for example, an increase of only 3.7 per cent is predicted, for Great Britain, however, an increase of 27.1 per cent is expected [2]. Approx. 80 per cent of municipal waste in these states (i.e. old EU Member States) is produced only by five countries: Germany, Great Britain, France, Italy, and Spain.

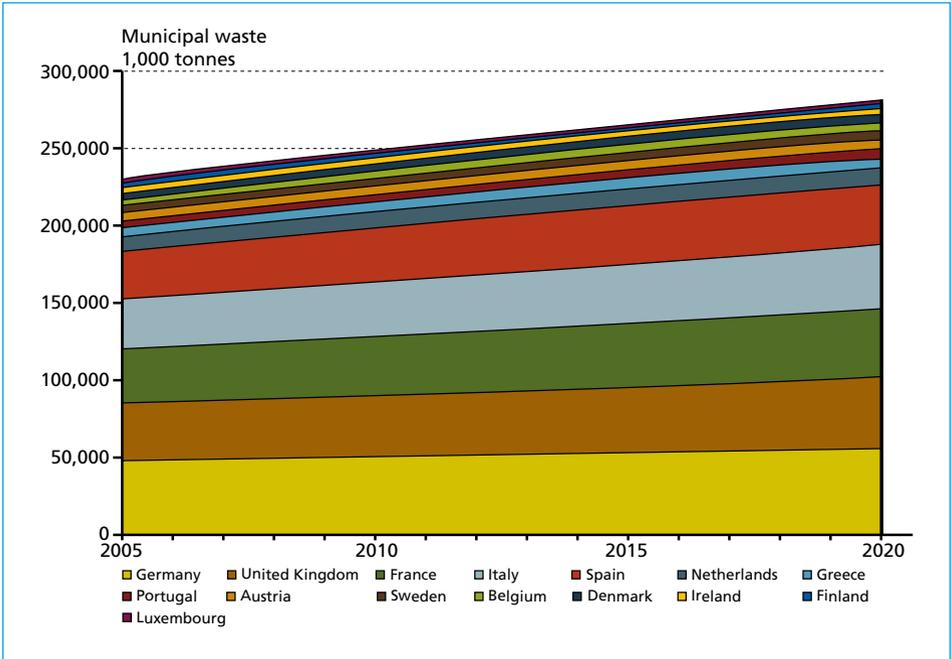


Figure 2: Municipal waste arisings in the EU-15 Member States, 2005 to 2020

Source: Environmental outlooks: Municipal waste. European Topic Center on Resource and Waste Management, 2006

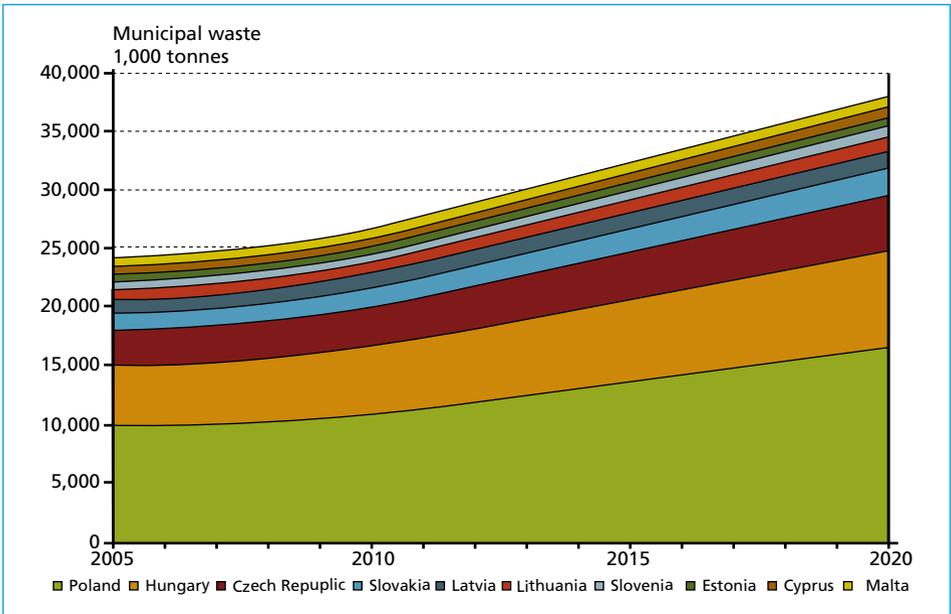


Figure 3: Municipal waste arisings in the EU-12 Member States (without Bulgaria and Romania), 2005 to 2020

Source: Environmental outlooks: Municipal waste. European Topic Center on Resource and Waste Management, 2006

Among the new Member States, Poland and Hungary are also the only two states that produce the largest share of municipal waste. Moreover, for both countries, a significant increase in waste revenue is also predicted.

As mentioned at the beginning of this section, there are many factors affecting the generation of waste. It is questionable as to what extent this can be forecast up to the year 2020 so as to make the respective realistic derivatives for the development of waste generation. From our point of view, a rather smaller increase in municipal waste generation should be taken as a starting point in developing the potential of the European waste incineration market.

In addition, the developments in the commercial waste sector may not be ignored. Reliable figures on the amount of these types of waste are not available, unfortunately. If a rate of 40 to 60 per cent of the total waste revenue is assumed, this will not constitute a non-negligible magnitude. In particular, because of rising commodity prices, it will be assumed that, in the future, increased efforts in recycling and reuse will take place, which should also result, due to the development of appropriate technologies, in a decrease in commercial waste production.

4. Waste treatment and management

The diversion of municipal waste away from landfill is the overall target of all regulations. Nevertheless, landfilling has been the predominant option in the EU-27 countries during the last years. 62 % of municipal waste was landfilled in 1995, this has been decreased to 40 % in 2008. A further reduction to 35 % by 2020 is expected.

Again there are notable differences between the EU-15 and EU-12 countries. Figure 4 shows that eight of the EU-15 countries landfilled less than 40% of the municipal waste in 2008. More than half of the EU-12 countries landfilled 80 % or more.

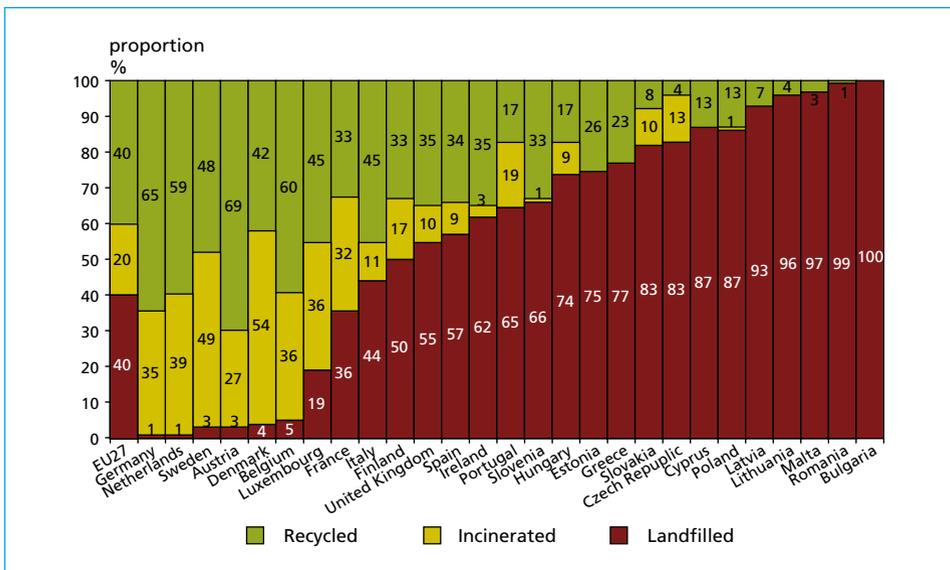


Figure 4: Municipal waste treatment in 2009

Source: CEWEP

Figure 4 clearly shows the variability of the extent of waste treatment methods for municipal waste in the European states. Some countries – the Netherlands, Sweden, Denmark, and Belgium – have already reached a very low deposition rate. In the same countries, but also in France and Germany, waste incineration has become a substantial part in waste treatment as a whole. The increase in the share of waste incineration is associated in most countries with an accompanying ban on the dumping of municipal waste.

According to data published by Eurostat 42 % (103 million tonnes) of municipal waste has been recycled (including composting) in the EU-27 Member States in 2009, 20 % (51 million tonnes) has been incinerated and 38 % (96.1 million tonnes) landfilled.

Eight of the old EU Member States already disposed of more than 20 per cent of municipal waste by incineration. This corresponds to an installed combustion capacity of about 50 million tonnes in the year 2005.

In the new Member States, the lack of treatment capacities is much larger. In Poland, there is only one waste incineration plant at its disposal, in Slovakia – two, and in the Czech Republic – three plants, respectively. Romania and Bulgaria have no waste incinerators.

Therefore, it is undisputed that the waste incineration market will continue to grow. In one country it will grow more, in another – less. The available total capacity has increased in the years 2006-2010 by more than 10 million tonnes to approx. 77 million tonnes. A further expansion of waste incineration capacity up to the year 2020 by around 30 per cent to more than 100 million tonnes is expected [3]. This growth is a consequence of the implementation of the EU Directives/Guidelines and is associated with the reduction of landfills.

5. Energy recovery

Every kind of energy generated and used from municipal waste replaces fossil fuels and conserves natural resources. In addition, the energy-related use of waste actively contributes to climate protection, since the energy content of municipal waste consists of more than 50 per cent from the biogenic component, and the energy exploited thereby from this share is being produced to a great extent CO₂-neutral.

Out of one tonne of municipal waste, depending on various factors, from 0.3 to 0.7 MWh of electricity can be generated. In case of combined heat and power, an additional 1.25 to 1.5 MWh of steam can be used.

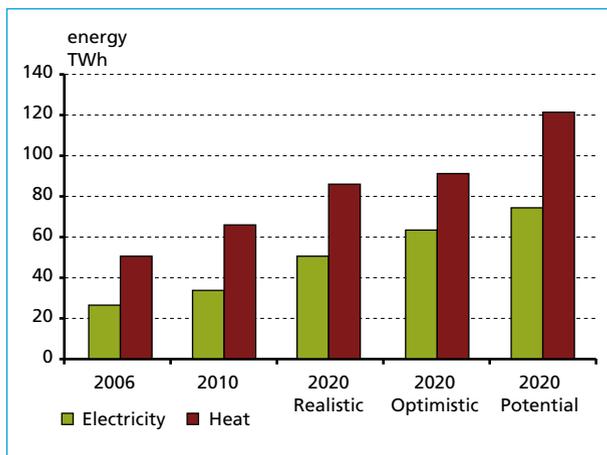


Figure 5:

Projection of total energy (in TWh) generated in EfW plants

Source: CEWEP

According to a survey of the Confederation of European Waste-to-Energy Plants (CEWEP), in the European waste incineration plants in the year 2006 approx. 35 TWh of electricity and 50 TWh of steam were produced. For the year 2020, CEWEP predicted an increase to approx. 60 TWh of electrical energy and approx. 85 TWh of steam. [3]

Following CEWEP's assumptions more of 70 billion Kilowatt-hours of renewable energy could be generated in Energy from Waste plants in 2020. This would be enough to supply more than 20 million inhabitants with renewable electricity and more than 10 million with renewable heat.

6. Summary

According to the European waste hierarchy, waste prevention has priority over recycling and disposal. Waste incineration has thereby no negative impact on the waste prevention and recycling. On the contrary, it is an indispensable part of sustainable waste management. Its primary goal is to dispose of not prevented and not recycled waste properly and without damage. Waste incineration also provides for long-term and, first of all, environmentally friendly disposal safety for the waste, which cannot be prevented and reused or is, respectively, non-recyclable.

An expansion of waste incineration does not inhibit the further waste prevention and does not preclude the further development of the European waste management sector. Since in a consumer society waste inevitably arises, as the last stage of the waste hierarchy, the thermal treatment of such waste, that is not otherwise recyclable in an environmentally friendly way, is also seen as necessary and appropriate in the future. The prevention of consumer waste is – after all the experience gained in recent decades – due to the waste legislation only conditionally possible. The choice of technical procedures of (residual) waste treatment does not affect the consumer behaviour of the population. Residual waste going into the combustion would arise, even without thermal waste treatment, in the same amount; this waste should, then, be landfilled.

Last but not least, the finiteness of fossil fuels, the increased demand for stable energy prices, and the CO₂ issue all lead to an increasing demand for alternative energy sources. Against this background, the issue of thermal recycling of waste (compared to mere disposal) becomes important across Europe. Consequently, the use of energy from waste in the combined heat and power sector at the European level, but also through national programmes, also becomes particularly encouraged. Energy-efficient energy-from-waste-concepts are, and will remain, a central element of the European waste policy.

To achieve the European goals for waste prevention, reduction of the landfill, and increase of the recycling rates, significant efforts are necessary; this requires, particularly, the transfer of such goals into the national legislations of the Member States and a stringent enforcement of those laws.

7. Literature

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