european bioplastics

FACT SHEET

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ENERGY RECOVERY

INDEX

1. DESCRIPTION OF TECHNOLOGY

Energy recovery from waste means the conversion of (non-recyclable) waste into usable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolization, anaerobic digestion, and landfill gas recovery. The most common thermal treatment is incineration; less common is the so-called advanced thermal treatment (ATT) implying technologies such as gasification or pyrolysis.

The incineration of municipal solid waste (MSW) is a technology to treat waste while both exploiting the energy content of the material and reducing the amount of solid material to be landfilled. Waste incineration plants can be used to produce electricity, steam and heating. Waste can also be used as fuel in certain industrial processes. The technology is also called thermal recovery or incineration with energy reclamation. Accordingly, such waste treatment schemes are also called Energy from Waste (EfW) or Waste to Energy (WtE).

Two main types of EfW systems can be distinguished: mass burn or refuse-derived fuel systems. In the first case, the input material is unsorted municipal solid waste burned without any pre-treatment, while in the latter case, the input stream is the result of a sorting process and has a defined quality. The basic steps are similar in all energy from waste plants. The thermal treatment essentially releases the energy from the waste. Afterwards, it is converted to a transportable form of energy, e.g. electricity, heat, or fuels. In a further step, the emissions are cleaned-up to ensure waste gases are safe. The incineration produces also solid outputs in a magnitude of around 30 percent of the input stream's weight. In many cases, the incinerator bottom ash is further treated in order to extract ferrous and non-ferrous metals, such as aluminium, copper, zinc and lead. The remaining bottom ash can be re-used by aggregate recyclers or in road construction.

Refuse derived fuels (also called solid recovered fuels) constitute a specific case of energy recovery in so far as the input materials are pre-processed. These fuels are treated to assure that they show defined characteristics, like physical properties (e. g. particle size, bulk density, heating value and moisture) and a certain chemical composition (e. g. content of chlorine and heavy metals). The solid recovered fuels are used in incinerators that can treat high calorific input materials. The material can be used for co-incineration in MSW incineration or cement kilns.

The energy efficiency of energy recovery installations for MSW can be distinguished in electrical and thermal efficiency. A number of plants are producing electricity or heat only. Others combine heat and electricity production, these are so-called combined heat and power plants.

2. CURRENT DISTRIBUTION

Energy recovery of MSW is a widespread technology in Europe. There is an inverse correlation to the landfilling practice in the single European countries. Countries with high level of landfill typically have few incineration capacities and vice versa. Figure 1 shows the waste management routes for post-consumer plastics waste in Europe. The installed capacity can be expected to grow significantly, especially in those countries that seek rapid exit from landfilling. Eastern and Southern Europe will be the main drivers in this development.

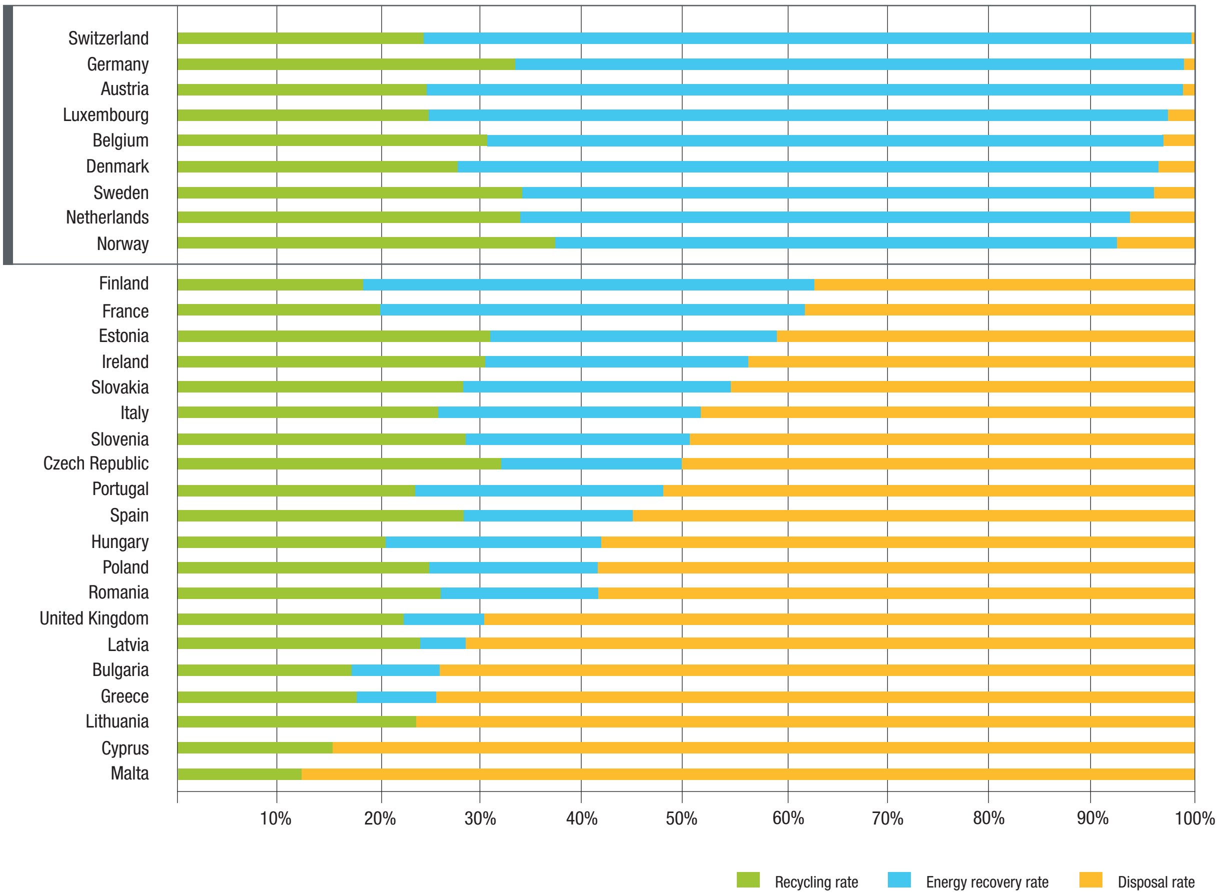

FIGURE 1 SHOWS THE WASTE MANAGEMENT ROUTES FOR POST-CONSUMER PLASTICS WASTE AROUND EUROPE (EU 27 + CH / NO IN 2012). COUNTRIES WITH LANDFILL BAN HAVE MORE THAN 90 PERCENT RECOVERY, I.E. BOTH MATERIAL RECOVERY (=RECYCLING) AND ENERGY RECOVERY. IT DEMONSTRATES FURTHER THAT COUNTRIES WITH ESTABLISHED ENERGY RECOVERY PERFORM WELL IN RECYCLING.

3. LEGAL AND POLITICAL FRAMEWORK

3.1 __ Landfill Directive

The EU Directive 1999/31/EC on the landfill of waste foresees that "only waste that has been subject to treatment is landfilled." In this context, the treatment is defined as "the physical, thermal, chemical or biological processes, including sorting, that change the characteristics of the waste in order to reduce its volume or hazardous nature, facilitate its handling or enhance recovery". This directive gives a strong push towards any option for recycling and recovery. The Commission proposal from July 2014 (see 3.5 below) aims at phasing out landfilling by 2025 for recyclable waste (including plastics, paper, metals, glass and bio-waste) in non-hazardous waste landfills, corresponding to a maximum landfilling rate of 25 percent.

3.2 __ Waste Incineration Directive

The Directive 2000/76/EC on the incineration of waste covers incineration and co-incineration with a view on prevention or limiting negative effects on the environment. In order to guarantee complete waste combustion, the Directive requires all plants to keep the incineration or co-incineration gases at a temperature of at least 850°C for at least two seconds. The heat generated by the incineration process has to be put to good use as far as possible. There are strict limit values for incineration plant emissions to air concerning heavy metals and many other toxic emissions. The Directive requires the installation of measurement systems to monitor the parameters and relevant emission limits. Emissions to air and to water must be measured periodically.

3.3 __ Waste Framework Directive

The EC Directive 2008/98/EC on waste generally advises to prefer any form of recycling over other types of recovery (e.g. energy recovery) and disposal. It requires that incineration facilities dedicated to the processing of municipal solid waste need to have an energy efficiency equal to or above: 60 percent for installations in operation and permitted before 1 January 2009, and 65 percent for installations permitted after 31 December 2008. The efficiency is depicted by the "R1 factor" (i.e. R1 ≥ 0.60/0.65). The efficiency is a cumulated value from electrical and thermal energy resulting from the incineration.

3.4 __ Packaging and Packaging Waste Directive

The EC Directive 94/62/EC on packaging and packaging waste foresees quotas for the recovery of packaging waste. For plastic packaging waste, a quota of 22,5 percent by weight has to be recycled or incinerated with energy recovery.

3.5 __ Review of waste policy and legislation

In July 2014, the European Commission adopted a legislative proposal under the umbrella of the Circular Economy Package to review waste- and recycling-related targets from several Directives. Concerning the Waste Framework Directive, recycling and preparing for re-use of municipal waste should be increased to 70 percent by 2030. Concerning recycling and preparing for re-use of packaging waste, the material-specific targets should gradually increase between 2020 and 2030, to reach 60 percent for plastics by the end of 2030.This proposal, however, was deleted together with the whole Circular Economy Package from the Commission's work programme 2015. A new and more comprehensive proposal – again including amendments regarding waste legislation – will be presented by the Commission presumably in 2015.

4. STANDARDS, CERTIFICATION AND LABELLING

Energy recovery is applicable for all types of bioplastics and their composites, regardless of their raw material basis, biodegradability or compostability. There is no material-specific standard in place. However, packaging in thermal recovery is governed by some standards:

- EN 13439 Packaging - Rate of energy recovery - Definition and method of calculation
- CR 13686 Packaging - Optimization of energy recovery from packaging waste
- EN 13431 Packaging - Requirements for packaging recoverable in the form of energy recovery, including specification of minimum inferior calorific value

A specific label or certification scheme is not required for being eligible to energy recovery. With regard to solid recovered fuels or refused derived fuels, the biomass content can be specified with radiocarbon measurement.[1] The determination of the renewable content of a product / waste stream can become relevant with regard to Emission Trading Schemes.

[1] CEN/TS 15747: Solid recovered fuels — 14C-based methods for the determination of the biomass content

5. INTERACTIONS BETWEEN BIOPLASTICS AND ENERGY RECOVERY

The energy content of bioplastics can be similar or equal to that of conventional plastics[2]. The difference lies in the chemical structure, meaning that a polyolefin has a higher heating value than a polyester, regardless of the biodegradability or renewability of the material. Accordingly, energy recovery is suitable for all kinds of bioplastics waste regardless of their renewability, biodegradability and compostability.

Compostable bioplastics that are certified according to EN 13432 potentially have lesser environmental impacts due to controlled low levels of heavy metals. Nevertheless, a main difference exists between conventional and biobased plastics. The CO2 generated by incineration of purely biobased polymers is neutral regarding the global warming potential, because the carbon content does not stem from fossil sources.

6. BENEFITS AND CHALLENGES OF ENERGY RECOVERY

6.1 __ Benefits

- The process can treat mixtures of plastic waste that are hardly recy clable otherwise (e.g. contaminated materials, small volumes that make separation economically unattractive or multilayer-materials).
- Energy recovery from bioplastics waste can contribute to resource saving by substituting emissions from oil / coal / gas firings for energy and heating purposes.
- Energy recovery can be the final destination in a use-cascade with previous re-use or recycling cycles.
- In the case biobased plastics are incinerated with heat recovery, renewable energy is produced, since the carbon is coming from a renewable resource – similar to using wood for renewable energy production.

6.2 __ Challenges

- Energy recovery limits the opportunities of cascade-uses, while other end-of-life options that allow for additional cycles may be more resource-efficient.
- The effective use of thermal energy often requires the use of district heating systems.
- Poor or incomplete burning of waste materials can result in environ mental and health damage through the release of hazardous chemicals, including dioxins and acid gases.
- Incineration of wet wastes reduces the energy efficiency of the process.

[2] Endres, H.J., Siebert-Raths, A: Technische Biopolymere, Munich 2009

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