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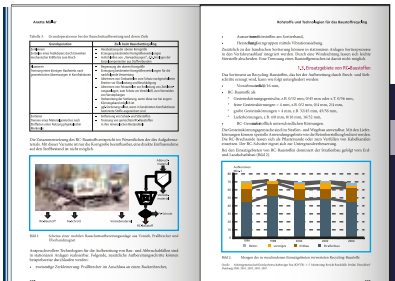

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Current Developments in European Waste-to-Energy

Ferdinand Kleppmann and Ella Stengler

In December 2015, one year after withdrawing the first Circular Economy package, the Juncker Commission published a *broader and more ambitious* proposal with revised targets and harmonized calculation methods for recycling.

In parallel, the European Commission is still working on the Energy Union, a strategy that is the core of the institution's work in which Waste-to-Energy will play a role.

Finally, the Commission will publish a communication focused on Waste-to-Energy aiming to explore the opportunities offered by Waste-to-Energy, particularly with regard to synergies between resource and energy efficiencies by the end of 2016.

1. Waste-to-Energy and the Circular Economy Package

The new Commission proposal is a positive step towards a circular economy. It proposes more realistic targets and introduces new elements ensuring a proper implementation. All these features make room for the important role of the Waste-to-Energy (incineration with energy recovery) sector.

1.1. New recycling targets and harmonized calculation methods

The package updates the recycling targets set by the Waste Framework Directive. These targets are inferior to the ones proposed in the previous version of the package, but are deemed more realistic by the Commission. They are as follows:

- Municipal waste: 60 percent preparing for reuse and recycling by 2025,
- 65 percent by 2030.
- Packaging waste: 65 percent reuse or recycling by 2025,
- 75 percent by 2030.

The reporting will be based on the input of the final recycling process. The Member States may take the recycling of metals from incinerator bottom ash into account as well.

In this context, the role of Waste-to-Energy is two-fold.

First, it directly helps the EU to achieve the recycling targets by extracting metals from the bottom ash. Ferrous and non-ferrous metals, once extracted, can be recycled into new products such as aluminium castings. This proposal will give Waste-to-Energy plant operators an additional incentive to improve metal recycling from bottom ash, which helps to avoid emissions of about 2,000 kg of CO_2 equivalent per tonne of metal recycled compared to primary production [2]. In 2014, European Waste-to-Energy plants produced approximately 18 million tonnes of bottom ash containing around 10 to 12 percent metals, both ferrous and non-ferrous. This leads to saving the emissions of about 3.2 million tonnes of CO_2 equivalent into the atmosphere.

As for the metal recovered from the bottom ash the same year, respectively 20,000 and 17,000 tonnes of aluminium were recovered from bottom ash in both the Netherlands and France. This metal was mainly used in castings for the automotive industry – engine blocks, etc.

Other remaining minerals can be used as secondary aggregates, e.g. in road construction or building products.

Secondly, following the waste hierarchy, Waste-to-Energy will help closing the circle by dealing with the waste that cannot be recycled in an environmentally or economically sustainable way. This was highlighted by the Environment Commissioner Karmenu Vella in a speech at the Dutch Parliament in April 2016, *The first objective of the circular economy package is to avoid waste in the first place. But you can never eliminate it all, and you can never recycle it all of it. However you can still gain by recovering energy from the non-recyclable materials* [1].

This opportunity offered by Waste-to-Energy is strengthened by the new target on landfill diversion proposed in the package.

1.2. Landfill diversion target

The Commission's proposal introduces a landfill cap, a 10 percent maximum of the total amount of municipal waste generated, to be reached by 2030. It offers additional years for a few countries in order to lower their landfill rates to this cap. A legally binding target to reduce landfilling waste that can be recovered is a very important step in order to achieve a circular economy.

A substantial amount of municipal waste is still landfilled in Europe with negative impacts: loss of energy potential, methane emissions, and potential danger for the groundwater due

to leakage. A recent study suggests that, *Diversion from landfill is the main contributor to greenhouse gas mitigation in the waste management sector*, and estimates that 92 million tonnes of CO_2 emissions could be saved by 2030 in the EU-28 if all the municipal waste would be diverted from landfill [4].

Following the Paris agreement of the COP 21, one could have expected more ambition from the European Commission. Aiming at 10 percent of landfilling still leaves around 24 million tonnes of municipal waste to decompose in landfills, releasing methane – a greenhouse gas 25 times more potent than CO_2 – and wasting its full potential. The 10 percent target is said to be more realistic and indeed, considering that today only 7 Member States of EU-28 landfill less than 10 percent and 8 Member States still landfill 60 percent or more of their municipal waste, we still have a long way to go. (Figures 1 and 2)

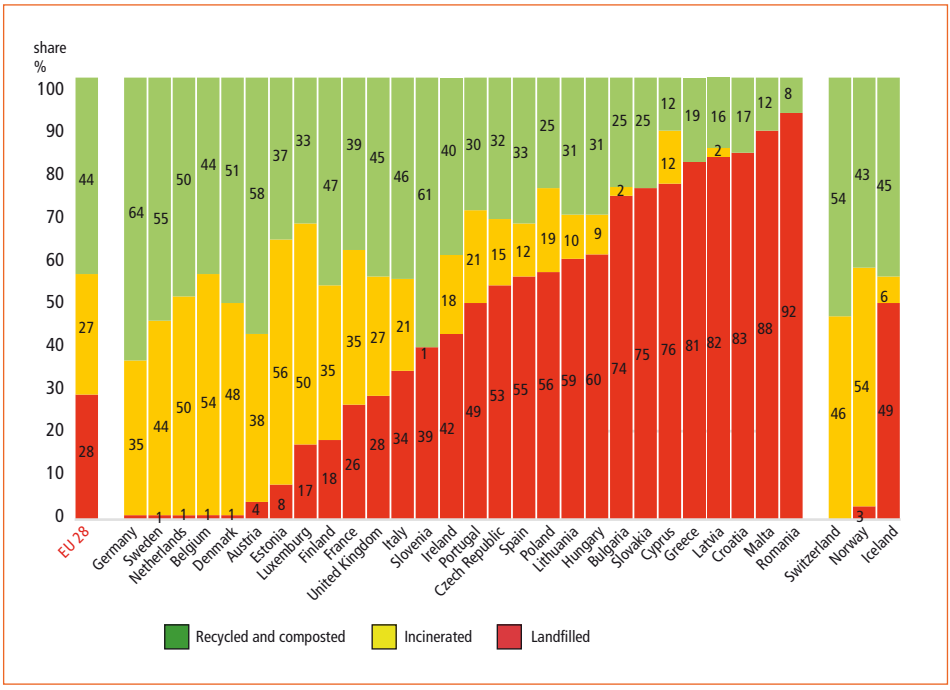

Figure 1: Municipal waste treatment in Europe in 2014

Data: Eurostat 2016

However, the European decision makers should be more ambitious regarding the scope of the targets. Currently, the focus is very much on municipal waste, when there is a huge potential for commercial and industrial waste to be better utilized within the circular economy.

Diverting more waste from landfill would be an incentive to improve the recycling efforts of European countries, and would allow the production of more energy with the residual non-recyclable waste. The quality of the recycled waste is crucial, and the package introduces measures in this direction.

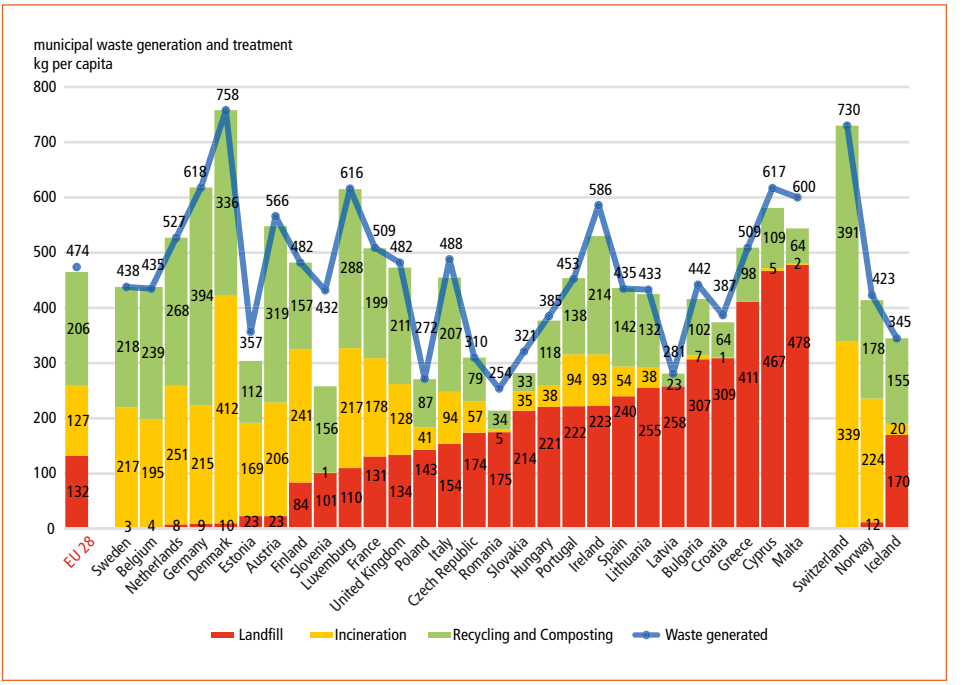

Figure 2: Municipal waste generation and treatment, 2014

Data: Eurostat 2016

1.3. Harmonised definitions and quality criteria for secondary raw materials

The new package proposes to harmonise the calculation of recycling rates based on what is actually recycled, i.e. the input of the final recycling process. It allows a proper comparison between countries, and ensures the traceability as well as the quality of the recycled products.

The Commission announces that it will tackle quality criteria for secondary raw materials. Plastic waste, for instance, is one of the waste streams that will be reviewed.

Focusing on quality rather than just quantity allows Waste-to-Energy to be most productive and efficient. It will keep the polluted waste – unsuitable for recycling – out of the circle and ensure a clean, circular economy.

2. Waste-to-Energy's contribution to an Energy Union

In February 2015, the European Commission launched its Energy Union strategy. As one of the core priorities of the Commission for the next five years, the Energy Union aims to create a unique European energy market that would *ensure secure, affordable and climate-friendly energy for citizens and businesses*.

On 16th February 2016, the Commission presented its new Sustainable Energy Security Package in the framework of the Energy Union. The package aims at strengthening *the EU's resilience to gas supply disruptions. These measures include moderating energy demand, increasing energy production in Europe (including from renewables), further developing a well-functioning and fully integrated internal energy market, as well as diversification of energy sources, suppliers and routes*.

The package consists of four documents. For Waste-to-Energy, the most relevant is the Heating and Cooling Strategy. Following the above-mentioned objectives, this strategy suggests – among other ideas – to increase the share of renewable energy solutions in buildings, to reuse the energy waste from industry via district heating systems, to develop cooling via cogeneration and to extend infrastructure. Waste-to-Energy can also weigh in on the security of the energy supply.

Also, the legislative pipeline includes the Energy Efficiency Directive Review. On 24th May 2016, the ITRE committee of the European Parliament adopted a draft report calling for a 40 percent binding energy efficiency target by 2030.

Waste-to-Energy has a role to play within all of these topics.

Waste-to-Energy is a renewable energy source, as indicated by the Renewable Energy Sources Directive. EU legislation considers the biodegradable fraction of municipal and industrial waste to be biomass and thereby a source of renewable energy. About 50 percent of the energy produced by Waste-to-Energy plants comes from biodegradable parts of the waste. Therefore, Waste-to-Energy helps European countries to reach their targets in share of renewables in the energy consumption.

In many countries and cities, Waste-to-Energy already reaches a high share of renewables in the energy mix. In Paris, three Waste-to-Energy plants provide 41 percent of the heat distributed by the district heating network. The renewable part of this energy allows the city of lights to reach 33.5 percent renewable energy share for its heating network, which keeps schools, museums, hospitals, collective housing and public administrations warm. These three plants have the capacity to provide energy to the equivalent of 205,000 households.

The European Commission is currently reviewing the Renewable Energy Directive and will publish its proposal by the end of 2016, together with the Waste-to-Energy Communication paper (see below point 3).

A resource for efficient district heating and cooling

The renewable energy potential, in particular, is highly under-exploited for District Heating and Cooling, which can play a key role in decarbonisation of the energy sector. For example in Eastern Europe, where district heating infrastructures (often) already exist, but only fossil fuels are used, where heat from Waste-to-Energy plants could be exploited. Waste-to-Energy already provides district heat in many countries, providing an alternative for imported fossil fuels.

The energy produced by Waste-to-Energy plants can easily be used by both citizens and businesses as it is the case in Rotterdam, where the AVR Rozenburg plant supplies steam to the industry located in the Rotterdam harbour, and heat to the District Heating network of the city. In 2013, this plant supplied 416 GWh of process steam to several industrial plants via a pipeline. The current pipeline, opened in 2015, provides heat to 95,000 households.

In Canton Lucerne, Switzerland, a newly opened Waste-to-Energy plant presents an important value for the local industry. Not only does the plant produce enough electricity to fulfil the need of 38,000 households per year, but it also provides heat to the nearby paper mill in order to dry the paper during the production line. The proximity of the two facilities allows an energy efficiency of 70 percent. By using heat from waste rather than from fossil fuels, the mill reduces the costs of its heating process, and saves 40 million litres of oil per year.

Waste-to-Energy and the *Energy efficiency first* principle

Waste-to-Energy plants consistently invest in new solutions in order to generate as much sustainable energy as possible from the residual waste. The *Energy efficiency first* principle should be properly considered in the design of a sustainable energy market. An example of such principle is the synergy between energy-consuming industrial activities and energy providers, where the energy produced is a by-product of other industrial activities. European Waste-to-Energy plants provide such synergy by treating residual waste and at the same time producing energy, most of them in Combined Heat & Power mode, and play an important two-fold role in waste management and energy systems.

By providing energy from local resources, Waste-to-Energy plants can help Europe to **tackle the issue of energy security**. The energy content of the waste treated by Waste-to-Energy plants in Europe amounts to 19 percent of the gas imports from Russia in 2012.

Already in some European cities, Waste-to-Energy provides 50 percent or more of the local heat demand. Waste-to-Energy could even contribute more, if the appropriate connection to heat (or steam) customers would be stimulated. Studies [3] suggest that the potential for using heat from waste can quadruple – from 50 to 200 billion kWh per year – by 2050, which shows that major opportunities exist for a further development of Waste-to-Energy is efficiency in Europe.

3. The upcoming European Commission's Waste-to-Energy communication

In the framework of the Energy Union, the European Commission is currently drafting a communication focused on Waste-to-Energy. According to the Commission's roadmap, it will aim to tackle the following issues:

- Lack of synergies between the Waste-to-Energy sector and EU Policies,
- Energy efficiency of the existing Waste-to-Energy processes,
- Uneven capacity,

- Untapped potential of waste-derived fuels,
- Lack of clarity with regards to the Waste Hierarchy.

A draft technical report was presented to stakeholders in March. It focused on the current waste streams for energy recovery, the technology and the possibilities to improve energy efficiency. Ideally, this communication would focus on two key issues: higher energy efficiency and better waste management, looking into the most relevant waste streams and into mature technologies.

In order to reach higher energy efficiency in the Waste-to-Energy sector, an acknowledgment of the synergies with existing and future exploitation of District Heating and Cooling systems and industrial heat use is essential. To further this efficiency, the European Commission should also emphasize the key role of grid access. Waste-to-Energy should not be put at a disadvantage in comparison to intermittent other renewable energy sources. Waste-to-Energy plants indeed achieve two tasks: to produce energy and to treat waste in an environmentally sound way. During peak energy supply from other sources, the plants cannot easily stop to process the waste that they receive as they still have to fulfil an important sanitary task to treat the waste in an environmentally sound way. However, during peak times from other energy sources, this could result in the loss of energy from Waste-to-Energy plants, and reduces the overall efficiency of the sector.

Figure 3: Map of Waste-to-Energy capacity in Europe, 2014

Data: CEWEP Members

Waste-to-Energy is also an important ambassador towards a better waste management. In order to further define this role, the upcoming communication should emphasise that Waste-to-Energy is necessary in order to achieve quality recycling and divert waste from landfills.

The Commission's communication paper will also tackle Waste-to-Energy capacities in Europe and how to use existing waste treatment capacities, e.g. exporting waste from countries which would otherwise landfill the waste. (Figure 3)

A draft Commission paper will be discussed by stakeholders in autumn 2016, before the final communication will be published by the end of the year.

4. Summary and outlook

With the new Circular Economy Package, the European Commission vows to take a more holistic approach to the transition from a linear model. It indeed provides more than targets in order to achieve a circular economy: it encompasses secondary raw materials, eco design, harmonized definitions, etc. It could have been more ambitious still in particular concerning diverting more waste from landfilling, but it is a step in the right direction.

Concerning Waste-to-Energy, the package proposes to include metal recovery from bottom ash as counting towards the recycling targets. This will put the sector more on the front line of the action towards a circular economy. Various representatives of the Commission, including Commissioner Vella, acknowledged that the quality of the recycled material is a key issue in order to create a strong secondary raw material market. Therefore, they agree that Waste-to-Energy has a role to play in the circular economy, by treating waste that is unsuitable for recycling in the most efficient way. It will keep contaminants and undesirable products out of the circle, while providing energy.

Waste-to-Energy is also a cornerstone between the Circular Economy and the Energy Union strategy, as it provides an opportunity for a better use of residual waste while producing reliable, affordable, clean, local energy that is 50 percent renewable. It answers to both challenges of increasing the EU's share of renewable energy while improving energy security.

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