

Gerhard Lohe and Dr Thorsten Becker, Doosan Lentjes, Germany, describe the development of thermal waste treatment in Poland, focusing on the plants in Krakow, Olsztyn, and Warsaw.

While the traditional focus markets in Western Europe for new thermal waste treatment plants are approaching saturation point, the situation in Poland is different. In recent years grate-based waste-to-energy plants have started operating more are currently under construction. All these facilities make an important contribution to improving Polish waste management as well as implementing legal requirements for sustainable waste management. Thermal waste treatment is an essential component of a sustainable resource-oriented circular economy with a greater emphasis on the protection of nature and recycling raw materials for as long as possible. The products and waste produced on the site should be minimised.

Thermal waste treatment not only protects the economy from toxic or non-recyclable waste but also recovers the energy contained in the waste as electricity and heat. Since the energy contained in municipal waste is high, this is the case in most EU countries, which makes it a climate-damaging process. Thermal waste treatment saves carbon dioxide emissions by burning waste for private and industrial use.

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valuable metals can also be recovered from the
bottom ash. The possibilities of energetic and
material recycling make it possible to use fewer
primary raw materials and new fuels.

Legal framework of waste management in Poland

According to the European Waste Hierarchy, thermal waste treatment is the method of choice for the safe and environmentally sound disposal of non-recyclable or contaminated waste. Since 2015, the legal framework for waste management in the EU has been the so-called circular economy package, including an action plan entitled 'Closing the loop - An EU action plan for the Circular Economy'.¹

FUTURE



Figure 1. Aerial view of the waste-to-energy plant in Krakow, Poland.



Figure 2. Construction of the new waste-to-energy plant in Olsztyn, Poland.



Figure 3. Visualisation of the new waste-to-energy plant in Warsaw, Poland. Source: MPO Sp. z o. o. w m.st. Warszawie.

The circular economy is an essential core component of the ‘European Green Deal’, which was announced by the EU in 2019 and represents the strategy of the community of states to achieve climate neutrality by 2050.

From 2035 onwards, the landfill quota will be set at a maximum of 10% by the adopted targets in the EU waste package, so that this option will no longer be available and thermal waste treatment will become unavoidable.

As a member of the EU, Poland has committed itself to meeting the targets laid down in the EU Waste Pact. In order to implement the thermal waste treatment infrastructure nationwide, the country launched and implemented a whole series of projects in recent years.

Establishment of the thermal waste management infrastructure in Poland

In Poland, it can be observed that waste volumes have increased since 2010 from approximately 12.1 million tpy to approximately 13.1 million tpy by 2020.^{2,3} Total waste generated is expected to stabilise at approximately 15 million tpy.

Since 2007, the year in which planning for the establishment of a thermal waste management infrastructure in Poland began, eight grate-based plants have gone into operation in the country (as of 2022). These have a total thermal treatment capacity of approximately 1.3 million tpy. Another four plants with a capacity of more than 600 000 tpy are currently under construction. Based on the targets of the EU waste package, however, a disposal gap of more than 2 million tpy is expected by 2034.

As examples, two of the plants currently under construction – Warsaw and Olsztyn, Poland – as well as the Krakow plant, Poland, which has been in operation for many years, are examined in more detail.

Krakow waste-to-energy plant – a role model for Europe

In October 2012, the contract for the construction of the Krakow plant was signed by both Krakowski Holding Komunalny AG (KHK SA) – a wholly owned subsidiary of the city of Krakow – and the Korean general contractor, Posco E&C. The German technology provider, Doosan Lentjes, was responsible for supplying the combustion grate system, boiler, and selective non-catalytic reduction (SNCR).

The two-line plant is designed for thermally treating 225 600 tpy of municipal waste and pre-treated waste, which corresponds to a large part of the waste produced by the approximately 760 000 inhabitants.

A proven two-stage air-cooled reciprocating grate system was chosen as the combustion system. The two five-pass boilers generate approximately 80 tph of steam, which is converted into both electricity and district heat in the downstream water-steam-cycle. An SNCR process is used to reduce nitrogen oxides.

Due to its high availability and performance, the current largest waste-to-energy plant has taken on a role model function for the planning of future plants in Poland.

Olsztyn waste-to-energy plant – compensation for closed coal-fired power plant

The Olsztyn project in north-eastern Poland was developed by Miejskie Przedsiębiorstwo Energetyki Ciepłej Spółka z o.o. w Olsztynie (MPEC). MPEC is a municipal company owned by the city of Olsztyn. The public-private partnership (PPP) contract for the implementation of the project was finally signed with the project company Dobra Energia dla Olsztyn in November 2019.

The PPP contract is structured as an operator model with a term of 25 years following a construction period of 36 months from financial closing. The legally valid building permit was granted in 2018, while the financing process was completed in August 2020.

Once completed, the single-line plant will thermally process 110 000 tpy of refuse-derived fuel from the greater Olsztyn area.

The new plant will meet approximately 30% of the district heating demand in the region and help to compensate for the heat loss associated with the closure of the local coal-fired Michelin power plant. This will ensure a continuously reliable and safe district heating supply for the population.

Doosan Lentjes, in a consortium with Korea's Doosan Enerbility, is the general contractor for the construction of the plant and is responsible for the design, supply, installation, and commissioning of the entire electromechanical equipment of the project.

The turnkey plant will be delivered including civil works and two gas/oil fired peak load boilers for additional district heating supply. The capacity of the incineration line, which is based on the proven water-cooled reciprocating grate system, is 48 MWth. The generated

steam produces electrical energy by means of a turbine and corresponding heat in a district heating station. By using the proven dry Circoclean® flue gas cleaning technology, including a downstream selective catalytic reduction (SCR), the plant will fully comply with the emission limits according to the revised EU best available techniques reference (BREF) documents.

Warsaw waste-to-energy plant – largest of its kind in Poland

In 2021, the contract for an extensive project in the Polish capital, Warsaw, was signed. The investor is the waste disposal company, Miejskie Przedsiębiorstwo Oczyszczania w m.st. Warszawie Sp. Z o.o. (MPO), which belongs to the city of Warsaw, and which awarded the general contractor contract to the Korean POSCO E&C. The project, called 'Expansion and modernisation of the municipal solid waste disposal plant', includes the construction of:

- > Two thermal waste treatment lines for municipal waste.
- > A bottom ash processing facility with recovery of ferrous and non-ferrous metals.
- > A modern automated waste sorting plant.

Doosan Lentjes was contracted to supply the two incineration process lines, including grate and boiler systems, as well as the SNCR process to reduce nitrogen oxides. Designed for waste with a calorific value of 10 MJ/kg, the throughput of each line is approximately 17 tph, resulting in a capacity of approximately 265 000 tpy. As in the Krakow waste-to-energy plant, the tried and tested air-cooled two-stage reciprocating grate was selected as the incineration system. Steam is generated in the downstream five-pass boilers, which is converted into both electricity and district heat in the subsequent steam cycle.

The project will be implemented according to the applicable European BREF standards. Once completed, which is planned for 2024 after a construction period of 36 months, the plant will be the largest of its kind in Poland.

The plants already in operation and those currently under construction are elementary in order to implement the requirements for legally secure treatment of non-recyclable or contaminated waste, considering applicable EU regulations in Poland. However, the goal of further efforts in the country must be to cover the still open capacity demand for thermal waste treatment by 2034 and thus to comply with the EU waste package's landfill target of a maximum of 10%. 

References

1. "Closing the loop - An EU Action Plan for the Circular Economy", European Commission: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Brussels, COM(2015), 614 final, (2 December 2015).
2. 'Ochrona środowiska Environment 2013', Główny Urząd Statystyczny Central Statistical Office, Warszawa, (2013).
3. 'Ochrona środowiska 2021', Główny Urząd Statystyczny, Warszawa, (30 November 2021).