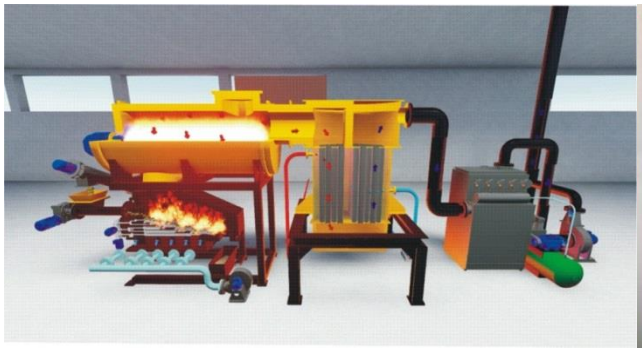
Small scale thermal processing of waste (300 kW - 5 MW)

Thermal processing of waste is a topic which is frequently raised in Europe in the light of the latest legal regulations on waste disposal. Our technology described below, was awarded at the International Environmental Protection Fair 2017 in Poznań under "Circular economy product" contest where it was positively verified by the experts of the Ministry of the Environment and the National Fund for Environmental Protection and Water Management.



According to the **Ordinance of the EU norms** about emission standards for certain types of installations, sources of fuel combustion and equipment for waste incineration or co-incineration corresponding emission standards have been introduced. They apply to the installations and equipment for waste **incineration and co-incineration** where the thermal power from incineration of dangerous waste exceeds 40% of the nominal thermal power of the equipment or where the incineration is carried out in such a way that the main purpose of the equipment is not to produce energy but to thermally process the unprocessed municipal waste. Therefore, emission standards expressed in mg/m3 have been defined in average daily and 30-minute values for a number of substances including: dust, hydrogen chlorides, hydrogen fluorides, carbon oxide, sulphur dioxide, dioxins, furans and other.

The Ordinance imposes the use of expensive waste gas cleaning and monitoring systems and, as the after-combustion performance of most of the thermal waste processing equipment is not of the highest level, it is generally believed that the operating cost of such an equipment is very high. The situation is different when the **after-combustion of the above mentioned substances** is performed **in an autothermal process** run with no additional energy supply which guarantees deep **waste gas cleaning before entering the heat exchanger**. **The measurements done so far show that, with the above mentioned technology, the emission standards are not only satisfied but, in some cases, the values of emission from our plant are a half of the maximum allowed level, e.g. carbon oxides 30 mg/m3 vs. maximum allowed value of 50 mg/m3, this being measured not on the stack but the equipment itself (fuel: sewage sludge).**

Utylizer system is composed of the following sections:

- feeding of input fuel e.g.: RDF, SRF or sewage sludge

- incineration – in a stepped zone furnace

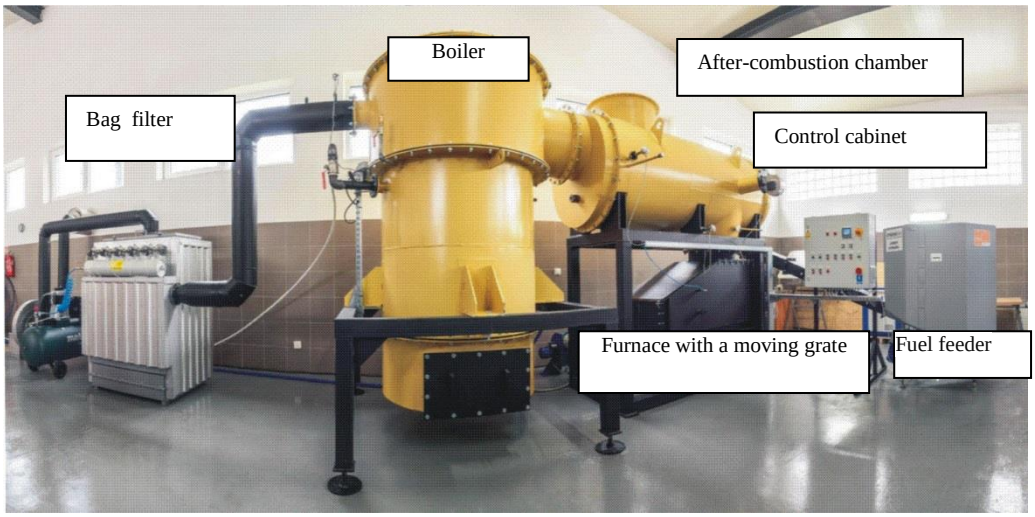
- after-combustion of gases in the temperature exceeding 850 °C where the gases remain in the gasification chamber for 2 seconds according to the directive requirements

- waste-heat shell boiler

- waste gas cleaning and filtration

- control and instrumentation equipment with optional monitoring and control system

Fig. Design of a sewage sludge treatment plant including thermal energy recovery

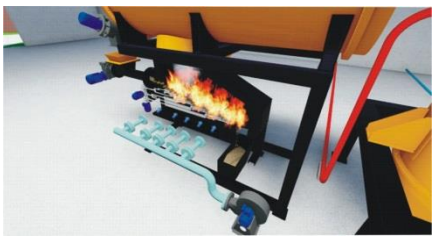


Our thermal waste treatment plant employs a stepped furnace with extended grate bar travel which allows strong degasification of fuel and, consequently, makes it possible to incinerate various waste types. In view of a small scale use, i.e. up to 5MW, the incineration tests carried out with various fuel types showed that the use of briquettes was the most reasonable as it reduces the cost of expensive fuel feeding and storage systems and the briquetting cost is much lower than that of pelletizing.

Thermal waste treatment system can be installed as stand-alone or a part of e.g. a sewage sludge or RDF drying facility. It is of great importance for constant heat reception because with the autothermal after-combustion system the system inertia is also high. Therefore, it is recommended to receive heat in a continuous manner and operate the system in an uninterrupted mode.

Description of waste incineration and after-combustion in our waste treatment plant:

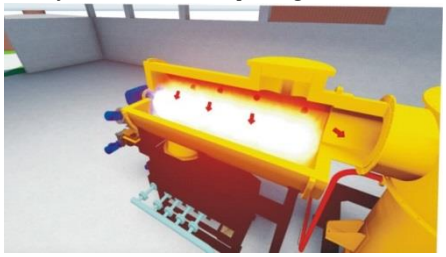
1. Incineration system: moving stepped furnace



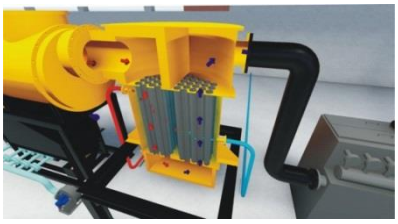
The principle of operation is based on the special zone furnace with a moving stepped grate awarded in GreenEVO programme. The grate bars are driven independently and the air is supplied to the zones by two or three fan blowers. With properly adapted parameters for the fuel-in-furnace residence time the fuel degasification and effective after combustion are possible. As it was mentioned before the fuel used was a sewage sludge, RDF/SRF and other alternative fuels based on those fuels which can be mixed with biomass to produce a system of co-incineration of biomass and waste which makes the acquisition of licenses and formal and legal approvals significantly easier.

2. After-combustion system: ceramic chamber

The system is based on a special gasification chamber for after-combustion of combustion gas produced during incineration in the stepped furnace. The after-combustion chamber has high temperatures where most of the harmful substances contained in the waste gas is treated. The chamber design with the waste gas circulation ensures that the combustion gas remains in high temperature for 2 seconds according to the regulation applicable.



3. Water, air or steam waste heat boiler



The plant described here is equipped with a water heat exchanger composed of seamless thick-walled tubes. The heat recovered can be used in the drying facility or heating systems according to the needs. Where the boiler is of steam type we can also design a complete cogeneration system where a steam turbine is powered and electrical and thermal energy is produced.

After passing through the waste heat boiler the waste gas enters the cleaning section which can be described in a separate article in view of its multi-level operation.

EXAMPLES OF TECHNICAL DATA UP TO 1 MW

Boiler type			**240**	**360**	**480**	**600**	**900**
Boiler power	Fuel – calorific value 14-16MJ/kg	kW	240	360	480	600	900
Combustion efficiency		%		< 88,7			
Hourly consumption of fuel		kg	100	150 -200	250-300	400-500	600-800
Allowed pressure		bar		< 6 bar			
Min. supply temp.		°C		65			
Max. supply temp		°C		90			
Waste gas temperature with rated power		°C		<120 °C			
Waste gas temperature with minimum power		°C		120-180			