Electricity and heat from waste materials

Did you know that your household waste is a valuable fuel for energy production? Electricity and heat can be produced using municipal waste.

Every year almost 300,000 tons of mixed municipal waste is left over from waste sorting in Estonian homes. In fact, the energetic value of the waste that is created in our homes and travels to landfills is equal to that of oil shale or woodchips. Instead of landfilling, waste should therefore be used for producing energy.

**OIL SHALE**
Calorific value 8-10 MJ/kg

**GENERAL WASTE**
Calorific value 8-14 MJ/kg
INCINERATION OF WASTE MATERIALS IS AN ALTERNATIVE TO LANDFILLING

Separating out packages, plastic, glass, paper and biodegradable waste is sensible and these materials should continue to be sorted and sent to recycling and for reuse. That is to say that using waste to produce energy does not compete with the sorting of domestic waste.

At the moment about 26–27% of municipal waste gets sorted and collected in Estonia, compared to 55–60% in the more progressive EU countries. In other words, with very good sorting and collecting less than half of the waste remains unsorted. And it is reasonable to use this unsorted waste to produce energy, instead of taking it to a landfill.

EESTI ENERGIA PRODUCES ELECTRICITY AND HEAT FROM WASTE MATERIALS

Eesti Energia began to use waste materials for energy production in 2013 at the Iru power plant, where a state of the art waste-burning combined heat and power unit was constructed. The Iru waste to energy (WtE) unit is capable of reusing about half of the mixed municipal waste produced in Estonia, or 220,000 tons annually. The completion of the WtE unit changed waste management in Estonia completely: large-scale landfilling has come to an end!

The Iru WtE unit has a heat production capacity of 50 MW and an electricity production capacity of 17 MW. Making use of the latest and most environmentally friendly incineration technology, around 82% of the energy contained in the waste is transformed into electricity or heat at Iru.

The Iru WtE unit produces about 136,000 MWh of electricity annually, which roughly equates to the electricity consumption of the town of Paide and the surrounding area. Eesti Energia transmits the energy produced from waste to the residents of Tallinn and Maardu through a district heating network. Iru WtE unit’s share in the Estonian heating market is around 20%. The heat produced from waste is also 25% cheaper than the energy produced from natural gas.

By using waste to produce energy, Eesti Energia’s Iru power plant saves 70,000,000 cubic metres of natural gas annually.
Working at full capacity, the Iru WtE unit burns an average of 27.5 tons of mixed municipal waste in an hour. This is roughly the amount of waste produced in 70 Estonian homes in a year. In one day, the unit burns an average of 660 tons of waste, working at full capacity. The Iru WtE unit uses 220,000 tons of waste annually to produce energy. Producing the same amount of energy would take:

- c. 220,000 tons of oil shale
- c. 70,000,000 cubic metres of natural gas
- c. 220,000 tons of woodchips

The Iru WtE unit receives an average of 80 garbage trucks daily. The waste materials are no longer sorted on site, as the technological solution of the WtE unit does not require mixed municipal waste to be crushed or sifted before incineration.

On entering the territory of the WtE unit, garbage trucks are checked with a radiation detector and weighed on an automatic scales. The vehicles are also weighed when leaving the territory. The waste is poured into the waste bunker in an enclosed waste reception area.

**RECEPTION AND HANDLING OF WASTE**

The WtE unit receives an average of 80 garbage trucks daily. The waste materials are no longer sorted on site, as the technological solution of the WtE unit does not require mixed municipal waste to be crushed or sifted before incineration.
The reception area and waste bunker are both located in an enclosed space, which is constantly kept under negative pressure, preventing any foul smell or dust escaping from the building. Two grab cranes work inside the waste bunker, mixing together a mass with maximally even heating value and feeding it into the furnace. The process is monitored and controlled from a control centre.

MODERN, EFFICIENT AND ENVIRONMENTALLY FRIENDLY TECHNOLOGY

The incineration system of the WtE unit at the Iru power plant is suitable for burning different types of waste, guaranteeing efficient, environmentally friendly and safe waste incineration.

The grate incinerator moves at a 26-degree angle and burns an average of 27.5 tons of municipal waste in an hour. The pitch and speed of the moving grates can be adjusted for an efficient and safe burning temperature, optimal speed of the process and full combustion. The technology used in the WtE unit does not require water cooling even in the case of waste with a very high heating value.

The heat released from waste combustion is used to produce overheated steam, which is guided to a steam turbine to produce electricity, using a turbo generator. The heat that remains after passing through the steam turbine is transferred to the district heating network through heat exchangers.

COMBUSTION GASES ARE CLEANED IN SEVERAL STAGES

Exceptional effort has been put into cleaning the flue gases of the WtE unit. For the flue gases to meet environmental standards, a semi-dry cleaning process and constant monitoring are used. Almost a third of the cost of the 105 million euro WtE unit was spent on cleaning systems.

An environmental impact assessment has shown the WtE unit to have no impact on the pollution level in the vicinity of the Iru PP. Possible additional emission up to 1%, and this without taking into account the reduction of the plant’s previous capacity.

The flue gases are cleaned in a reactor, where different reagents are used for the process. The reagents are injected into the reactor using an injection turbine, ensuring that the flue gases get the necessary contact with the chemicals. The dioxins, heavy metals etc. produced in the waste combustion process are neutralised with activated charcoal after the cleaning reactor. After being cleaned in the reactor, the flue gases also pass through fabric filters, which capture dust and solid particles.

A state of the art online monitoring system is also used to prevent excessive emissions being released into the atmosphere. The system guarantees that the WtE unit either meets the strict environmental regulations or stops production. The data from the WtE unit are available at all times and are subject to state supervision.

The WtE unit has less environmental impact than the adjacent biofuel-based combined power and heat plant, trucks moving on the Narva highway and a couple of dozen private homes.