



Thermal treatment of waste

The thermal treatment of waste in a waste-to-energy (WtE) plant is undertaken around the world in communities where waste would otherwise be disposed of to landfills. Some treatment facilities are located in urban areas without concern from neighbours because they are properly designed and operated so that they meet required environmental standards.

The following address questions often raised by those within the communities where thermal treatment facilities are proposed.

What are the different types of WtE plants and processes?

There are four main WtE technologies that are available for the processing of different forms of waste.

1. *Pyrolysis* – a process of chemically decomposing organic materials at elevated temperatures in the absence of oxygen. The process typically occurs at temperatures above 430°C (800°F) and under pressure. Volumes are limited and temperatures are too low to effectively breakdown some waste components
2. *Plasma Arc Gasification* – is an extreme thermal process using plasma which converts organic matter into a syngas (synthesis gas) which is primarily made up of hydrogen and carbon monoxide. A plasma torch powered by an electric arc is used to ionize gas and catalyse organic matter into syngas, with slag remaining as a by-product. This process has not yet been commercially proven at the volumes of feedstock required.
3. *Thermal treatment* - is a waste treatment process that involves the combustion of organic substances contained in waste materials. Combustion of waste materials converts the waste into ash, flue gas and heat. This is the most common and most efficient waste treatment process.
4. *Gasification* - is a process that converts waste materials into carbon monoxide, hydrogen and carbon dioxide. This is achieved by reacting the material at high temperatures (>700 °C), without combustion, with a controlled amount of oxygen and/or steam. The resulting gas mixture is called syngas or producer gas and is itself a fuel. Electricity and heat is derived from gasification and then the combustion of the resultant gas.

Are waste to energy (WtE) plants a wasteful use of a resource?

WtE plants are like a high performing recycling facility at the same time as generating energy from waste that would otherwise be heading for the landfill.

The municipal and commercial residual waste that is not recycled and that would normally end up in a landfill, is processed through the WtE plant, where energy is extracted from the materials able to be thermally treated.

Any metals, glass or other non-combustible materials that end up in the mix, is extracted from the bottom ash and recycled after the thermal treatment process. Examples are nails in wood, zippers from clothing, copper wire bits, stainless steel ballpoint pen tips, gold soldering in electronic circuit boards, etc. None of

this would be efficiently recovered using any other current system of recycling. Bottom ash (non-toxic) is then recovered and available for paving, roading aggregate etc.

Is waste an efficient fuel?

WtE plants would not be in existence if they were not efficient, and governments and companies around the world would not invest all their funds if they were not confident of the efficiency of the process. WtE plants that produce steam, hot water and electricity are 80% efficient.

Is combustion of waste a source of renewable energy?

Combustion of waste is seen by many countries as a source of renewable energy since full elimination of all waste and total recyclability is not currently possible. In the New Zealand Government's recent 'Well-Being Budget' 2019, waste to energy is listed as a renewable energy source.

'Separated municipal solid waste (MSW) is considered to be a renewable resource'¹.

What temperatures and standards will thermal treatment plant follow?

Burners are activated when the boiler is powered up or down in order to guarantee the minimum temperature of 850°C up to 1,000°C for a minimum of 2 seconds. This extremely high temperature is required to ensure proper breakdown of toxic organic substances. Additionally, flue gas treatment process, ensures the proper elimination of all harmful substances in the exhaust gases. The highly stringent European standards as set out in the Industrial Emission Directive (IED), are followed.

How much water will a WtE plant use and where will it come from?

The volume of water used in thermal treatment will be determined by the cooling requirement of the facility. Some facilities can work on zero consumption through cooling and recycling water.

Is there any danger to birds or wildlife?

There is no danger to birdlife or any wildlife. Emissions from modern thermal treatment plant are significantly lower than those approved by the EU, which is more stringent than NZ requirements.

Does burning of waste produce toxic emissions?

Many toxins are produced from thermal treatment of waste however the technology available today ensures all emissions are cleaned and all dangerous toxins are collected through the process before reaching the atmosphere. This process is called 'scrubbing' and uses filters, activated lime and carbon to achieve compliance.

'Emission control systems' are well proven commercially and are guaranteed to meet (in most cases well below) the stringent European standards set by the EU, which are far more stringent than the RMA in New Zealand.

Does WtE contribute to climate change?

All WtE plants generate CO₂. CO₂ generation is associated with combustion of plant or animal-based products (paper and forest products, garden trimmings, food discards) which are considered to close the loop in the natural carbon cycle.

¹ Source: USA EPA 2010

The CO₂ emissions from combusting these materials are not counted in greenhouse gas (GHG) inventories². However, CO₂ is a valuable by-product. There is technology available now to capture this CO₂. Often equipment will capture the CO₂ from the process and make this available to a nearby commercial 'green house business'.

Are WtE plants a financial burden for a community?

Most WtE facilities are a private investment and not a community owned asset, therefore are not a risk or burden on the community. The WtE facility operator is responsible for sourcing residual waste for the facility.

Do WtE plants reduce recycling industry staff levels?

Most WtE facilities throughout the world process residual waste after the recycling industry has extracted everything it can. This has an advantage to the facility operator as non-organic wastes are removed prior to processing, and this also provides an assistance to recyclers as there is a revenue stream for organic waste which would otherwise be disposed of to landfill at a cost. The focus of all involved is to reduce waste disposal to landfill. The WtE facility will only process residual waste that is destined for landfill. The recycling industry will not be affected, in fact it is assisted.

Does WtE fit into a sustainable circular economy?

A circular economy is an economic system aimed at minimising waste and making the most of resources³. By pre-processing waste (after the recycling industry has extracted the valuable materials) into Refuse Derived Fuel (RDF), extraction of energy and recoverable recycled materials, is a sustainable example of the circular economy.

Is EfW working against the circular economy producing toxic waste, air pollution and contributing to climate change?

To meet the compliance levels under the Resource Management Act a WtE plant must use the highest level of emission cleaning technologies to remove and contain the toxins that would normally end up in landfill and potentially leaching into our environment. These toxins are managed safely to ensure there is no effect on the environment.

Are developed countries moving away from WtE and embracing zero waste?

Developed countries throughout the Northern Hemisphere are embracing zero waste by establishing WtE facilities to process their waste, generate electricity and supply home heating from residual hot water. There are over 3800 WtE facilities operating today and currently approximately 2430 use the similar thermal treatment technology proposed for Hokitika, New Zealand. The increase in communities adopting zero waste to landfill policies (eg Auckland, New Plymouth) are encouraging an international move towards WtE with the example of three such plants proposed for Australia, and most other countries involved in new and planned facilities.

The only WtE plants that are closing are those no longer viable to upgrade. Many older inefficient WtE Plants are being upgraded to new technology. There are new projects announced and WtE Plants opening on a very frequent basis.

² Source: US Govt Environmental Protection Agency EPA

³ Wikipedia

When was the last WtE plant commissioned in the USA?

At the end of 2015, the United States had 86 WtE plants that generated electricity in 25 US states, with a total generating capacity of 2.3 gigawatts of electricity.

The most recent WtE plant was constructed and commissioned in Palm Beach (Florida) in 2015. Renewable Energy Facility No 2 is the newest energy from waste facility in the US. The million tonne per year mass burn facility generates up to 95MW of electricity.

How come some countries in Europe are importing waste?

Many European countries operate within a zero waste target policy. To achieve this target, they process all their residual waste through high performing environmentally clean WtE plants. These plants not only generate electricity for their cities, but also provide heating for the homes from the residual hot water from the plant. This economic solution encouraged countries to establish more WtE plants than waste available to supply them, knowing they were able to import waste. The waste that is imported is pre-processed into sealed bales of RDF and transported from UK and other countries by rail, road and sea transport in a safe and environmentally clean manner.

Why not use anaerobic digestion technology instead of combustion technology

Anaerobic digestion of waste is a suitable technology for treating wet wastes but when waste has a high level of dry components then combustion technology is often more efficient. Technically either technology can be used to treat waste to produce energy, but the choice of technology will depend on the sources and moisture content of the waste feedstock.

Will a WtE plant pollute the air?

Modern technology used in WtE Plants ensure they meet the tough European emission standards, which are more stringent than the current NZ Air Quality acceptable levels. The Resource Management Act and resource consenting process will ensure the air quality standards are met.

Will there be any leaching from stored bales of EDF or from anywhere else onto the land?

The bales that will be stored on a WtE site should be completely sealed in wrap so that they will not leach or emit any substances. The areas on a WtE site where the bales will be stored should be contained and compliant to any consent conditions so that they protect the environment. The reason for the storage of bales is due to providing the Plant approximately a 3-month window of feedstock supply (est. 80,000 bales) on site to ensure processing capability if the event that there is any supply or transport disruption for a period.

Who would want to live under or beside an WtE Plant?

Many of the European and Northern Hemisphere WtE Plants are located within cities. An example is Copenhagen City. The WtE Plant was commissioned in 2018, boasts a ski slope on its roof and trees growing also. The ski slope reverts to a cycle park during summer. This epitomises the clean environment from these WtE plants.

Is there a major concern from fires of the stored RDF bales?

Internationally there have been no fires in stored bales of RDF at WtE plant. There was one fire in Europe that was intentionally lit. By compressing the waste to 1 tonne/m³, and sealing the bale from air, effectively eliminates the possibility of fire. Normal waste processors in NZ don't compress baled waste in this manner. Any waste fires in NZ have been with waste that has not been highly compressed.

Is there any contamination from a WtE Plant?

The Resource Management Act (RMA) in NZ is in place to protect the environment from contamination. Any proposed WtE Plant will have to comply with all facets of the RMA and will do so. Therefore, there will be no contamination from a plant or from the stored RDF.

What happens to all of the bottom ash?

The Bottom Ash is nontoxic residue of a WtE Plant and is processed to remove any recyclable materials such as glass, metals, aluminium and precious metals. The residue after this process is then able to be used as roading aggregate or paving, concrete blocks etc.

What about the toxic ash? Where does that go?

The Fly Ash is toxic and is mixed with cement to contain the toxins and disposed of into consented landfills.