

## Energy from burning waste

### Where does all my non-recyclable waste go?

People produce enormous amounts of waste. The World Bank has estimated that, averaged across the Earth, each person produces more than 1kg of waste per day, but this is uneven, some regions producing far more waste than others.

Methods of waste management differ from region to region and have changed over time, but modern methods usually involve the 'three Rs' of 'reduce, reuse and recycle'. These three aim to extract the greatest value from the waste and dispose of the minimum amount of material. However, there is still some waste that cannot be recycled or reused:

- domestic waste
- inert waste - chemically unreactive e.g. building rubble
- toxic waste - chemically reactive, e.g. paint, oils, chemicals
- radioactive waste - this releases damaging radiation for thousands of years or more.

#### Domestic waste

In many countries non-recyclable or re-usable waste is disposed of in landfill sites – often old quarries or brick pits but these are finite in number and have to be managed carefully.

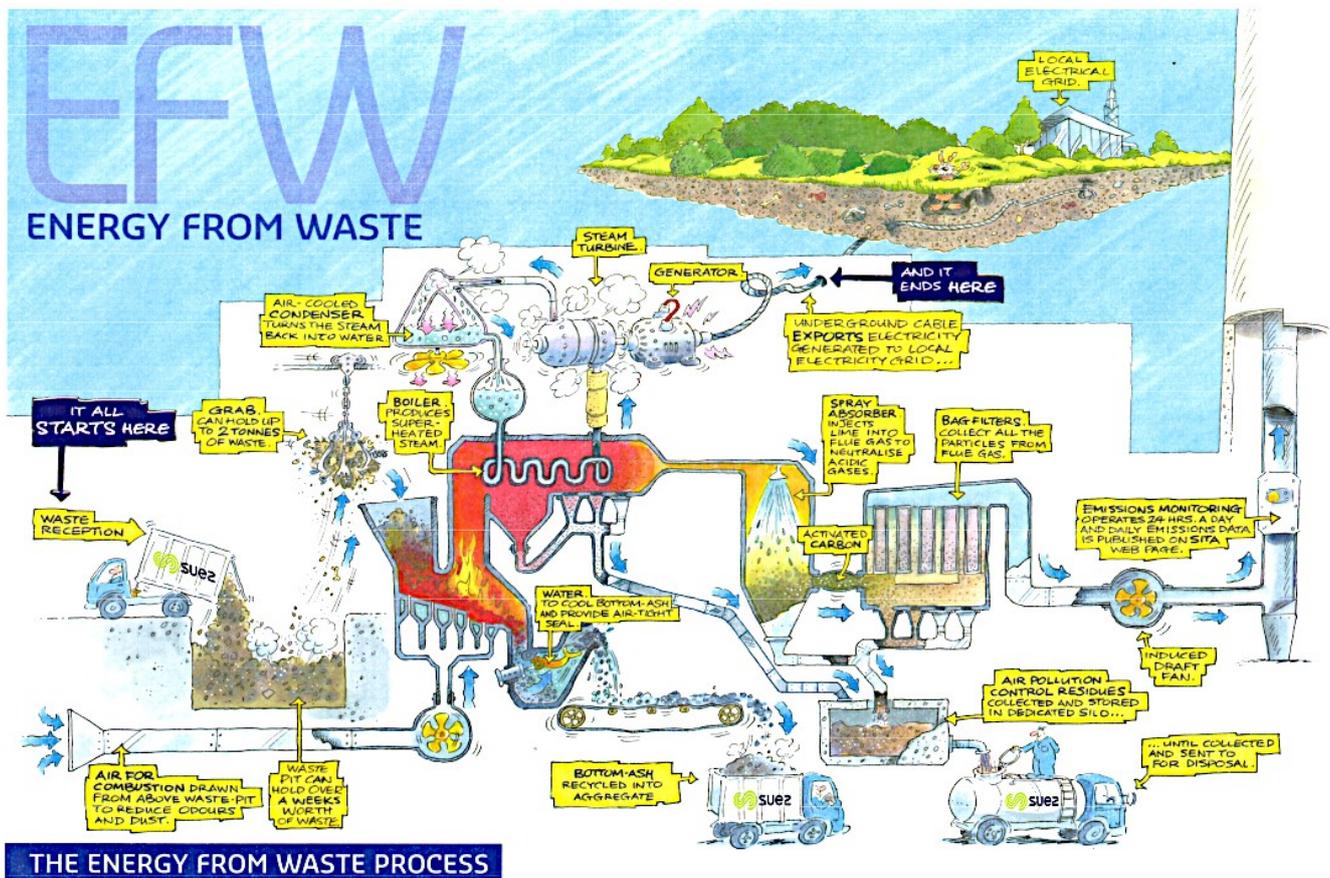
However, in many areas of the world, domestic waste is burned to produce electricity.



Edmonton Waste Incinerator, North London  
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**Ask the pupils** to study the diagram below and make a table to show all the processes that are happening. For each process, give a tick if carbon dioxide emissions are zero and a cross if they are not.

Use the table on page 2 to explore the processes with the pupils adding extra information.



*Processes:*

waste arrives by lorry (probably burning diesel) and is put into a waste pit	x
mechanical grab (probably burning diesel) collects waste	x
grab puts waste into the furnace	x
waste is dried before being burned at temperatures around 1,000°C; if the burn temperature is allowed to drop too low, dioxins can be produced (dioxins are persistent organic pollutants POPs)	√
air for combustion is drawn from above the waste pit to reduce odours and dust	√
hot flue gases pass through a boiler, and are mixed with water to create steam. This super-heated steam goes to a steam turbine	√
steam drives the steam turbine	√
exhaust steam returns through an air-cooled condenser which turns steam back into water - a closed-loop system	√
steam turbine drives the generator which produces electricity	√
underground cable exports electricity to the local grid	√
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water cools the Incinerator Bottom Ash (IBA) and provides an air-tight seal	√
IBA travels on conveyor to a storage pit; magnets extract iron-rich metals which are recycled	√
IBA is recycled into aggregate and taken away by lorry	x
flue gases, produced by burning, are sprayed with lime to neutralise acidity (process of making lime emits CO <sub>2</sub> )	x
gases pass through activated carbon which picks up residual contaminant gases, such as nitrogen compounds	√
bag filters collect all the particles from the flue gases	√
residue flue gases from the boiler and from the filters are collected by lorries and stored in dedicated silos – the bulk is very small compared with the bulk of the original waste	x
flue gases pass through an induced draught fan to an exhaust pipe; they are monitored 24 hours a day and the data are published on a web page	√

**Back up**

**Title:** Energy from burning waste

**Subtitle:** Where does all my non-recyclable waste go?

**Topic:** Discussion about the treatment of domestic waste

**Age range of pupils:** 14 years upwards

**Time needed to complete activity:** 30 minutes

**Pupil learning outcomes:** Pupils can:

- realise that people produce an enormous amount of waste;
- realise that waste has to be managed in a way that does least harm to the environment;
- explain that modern methods of waste management usually involve the 'three Rs' of 'reduce, reuse and recycle';
- explain how electricity can be produced by burning domestic waste;
- describe how the gases and residues from burning are managed to keep pollution to a minimum.

**Context:**

The population of the world is increasing rapidly and with it the amount of waste material. It is vital

that modern technologies are developed not only to manage the waste but also to ensure that no harmful by-products are allowed to pollute the air or the ground. We must re-cycle as much as possible and mitigate the effects of non-recyclable material.

**Following up the activity:**

- Research what happens to the domestic waste in your area. Details are usually given on local websites.
- Discover what happens to the recycled material in your area. Is plastic sent overseas and, if so, what happens to it?

**Underlying principles:**

- People produce an enormous amount of waste.
- Modern methods of waste management usually involve the 'three Rs' of 'reduce, reuse and recycle'.
- Available landfill sites are becoming scarce in many countries.
- Increasingly, much domestic waste is burned to produce electricity.
- Where domestic waste is burned, harmful gases and residues are kept to a minimum.
- Producing electricity from waste instead of using fossil fuels such as coal, gas, and oil, helps to reduce greenhouse gas emissions.

- Countries differ enormously in how they manage their waste material.

**Thinking skill development:**

A pattern emerges when investigating how a waste disposal incinerator works. Discussion of all the stages of the process involves metacognition and may include cognitive conflict. Applying what happens in the diagram to the real world is bridging.

**Resource list:**

- diagram of a waste disposal incinerator
- access to the internet

**Useful links:**

Any UK County Council's website.

Search 'net-zero' on the Earthlearningidea website to find other Earthlearningideas relating to climate change mitigation or adaptation. Use a search engine like Google to explore the internet for more information about likely global impacts of 'net-zero'. You can access a tool to help visualise how climate change might affect your local area in the UK at:

<https://www.bbc.co.uk/news/resources/idt-d6338d9f-8789-4bc2-b6d7-3691c0e7d138>

**Source:** Elizabeth Devon of the Earthlearningidea Team with reference to Exploring Geoscience across the globe, IGEO

<http://www.igeosied.org/teaching-resources/geoscience-text-books/>

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