



IEA Bioenergy
Technology Collaboration Programme



An overview of Waste-to-Energy technologies

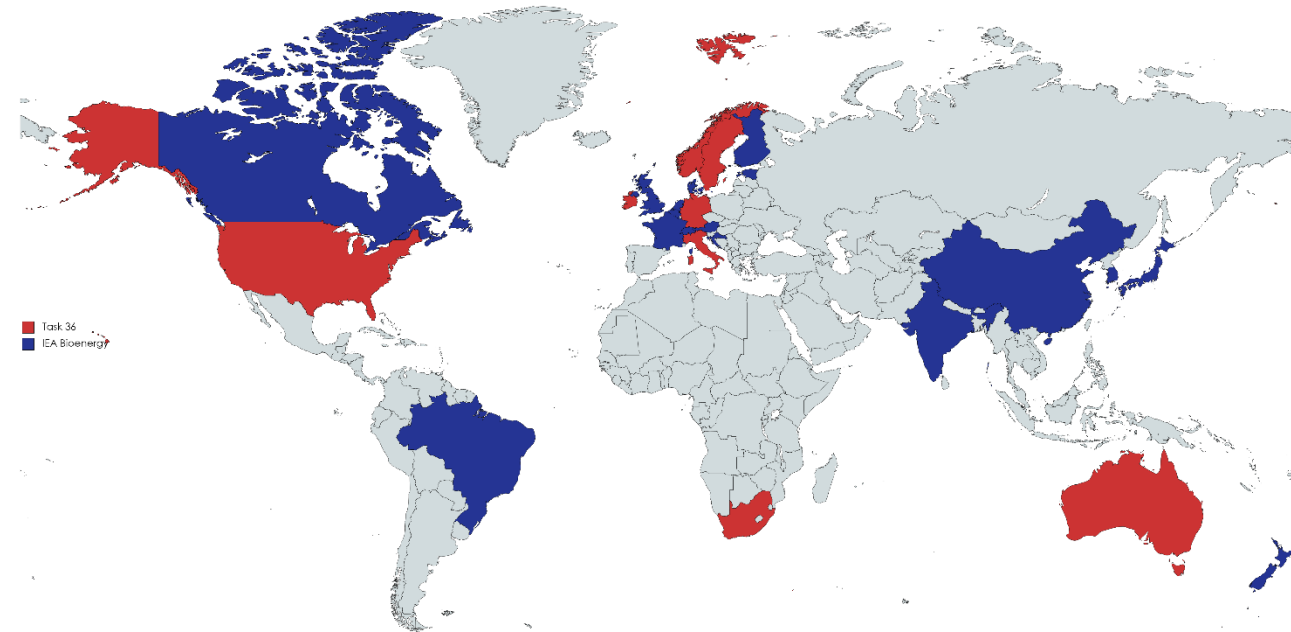
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IEA Bioenergy- Task 36: Material and Energy valorisation of waste in a Circular Economy

- Working with scientific facts to promote the sustainable use of bioenergy.
- Task 36 one of eleven tasks working with different aspects of bioenergy.
- Task 36 working on a broad horizon, with everything from the feedstock to technology and system aspects.



What is Waste-to Energy?

Depends on who you ask...

- Landfill gas, incineration, anaerobic digestion, alternative thermal conversion, RDF production
- Residues from agriculture, residues from forestry, municipal solid waste, other waste (C&I, C&D)
- Products like electricity, heat, (cooling), liquid or gaseous fuels, but also new materials/chemicals

So what isn't Waste-to-Energy?

A one stop solution of the waste crisis around the world...

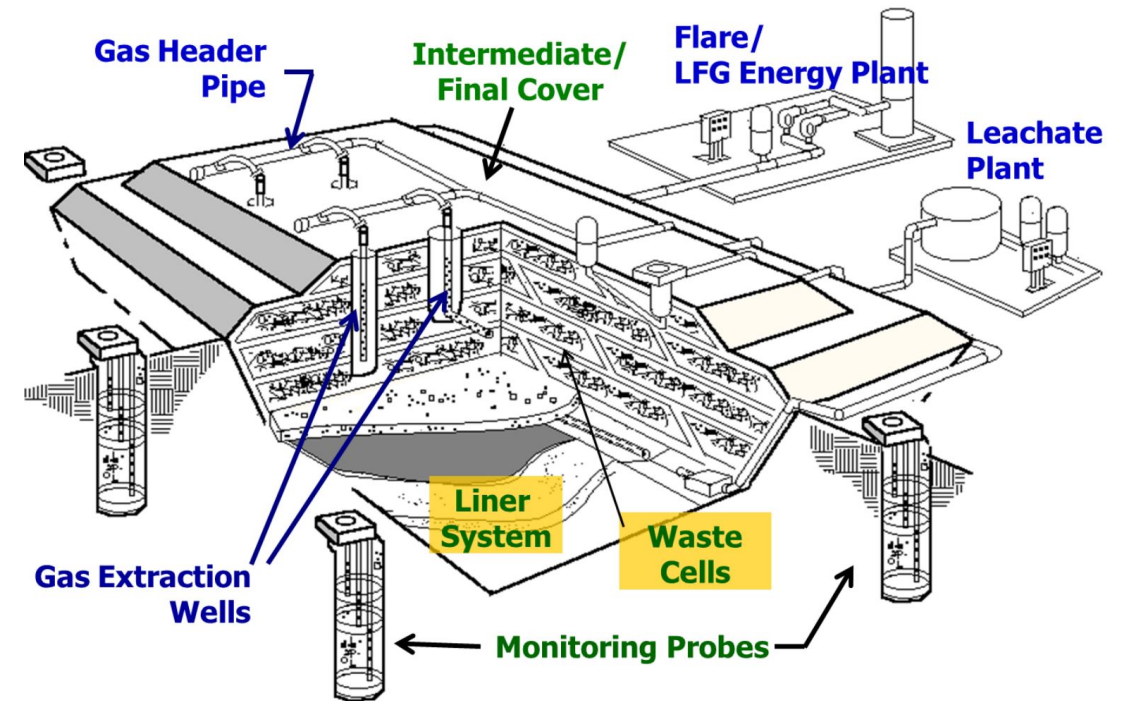
W-t-E cannot solve the increasing amounts of waste and extraction of resources.

However, it can be a part of an integrated solution to a more sustainable future, together with waste minimisation, re-use and recycling



Landfill gas

- Collect the methane formed in landfills
- Can be applied on both old landfill and new ones (mandatory on new landfills in a number of countries)
- Gas can be used for generating electricity, heat or be upgraded to renewable natural gas



Anaerobic digestion of food waste

- Recovers energy and nutrients (if well managed)
- Proven technology that works in different scales
- Demands source separation of organic waste if nutrients are to be recirculated
- Gas can be used directly to generate electricity/heat or be upgraded (but then a certain scale is needed)
- 100% renewable
- Important that the plants (no matter the scale) is designed to **minimise methane slip**



Source:
[Food waste WEB_END.pdf \(ieabioenergy.com\)](https://www.ieabioenergy.com/food-waste-web-end.pdf)

Waste Incineration/Combustion



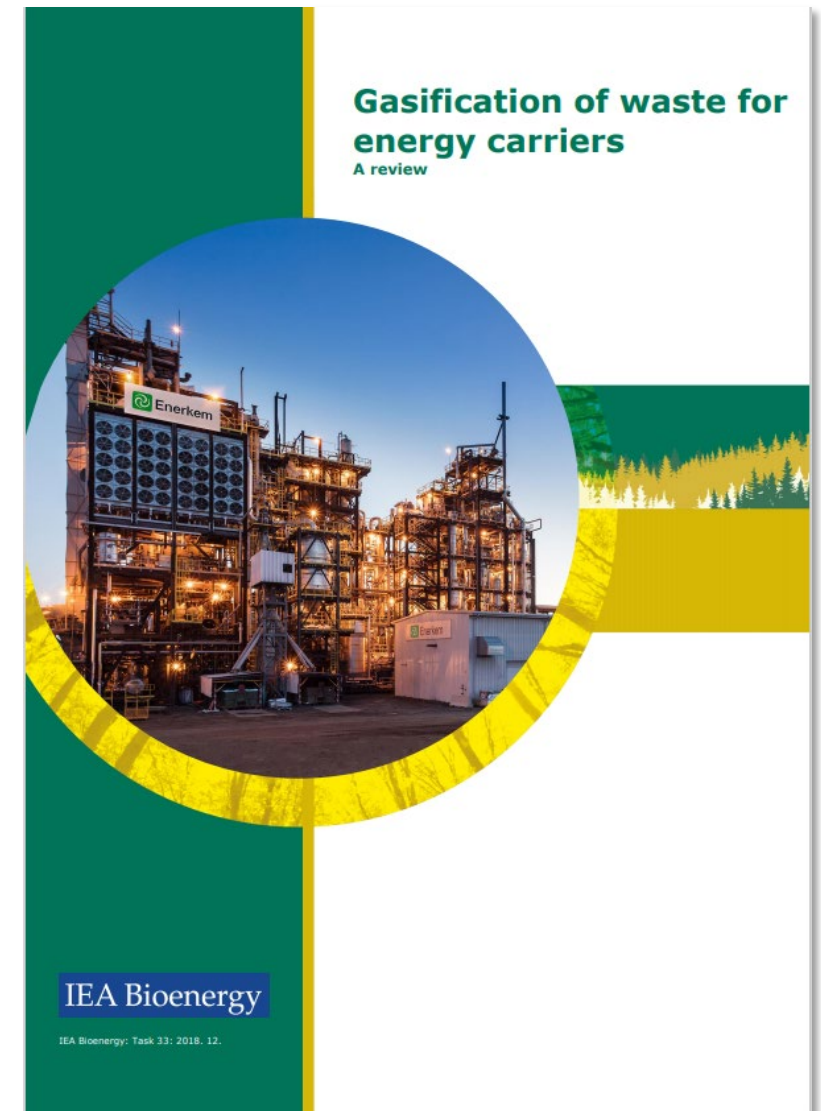
Copenhill Waste-to-Energy plant

- Sanitising waste and minimising volume
- Recovers energy (electricity, heat, cooling)
- Robust, proven technologies
- Subject to economy of scale

- Will generate a significant amount of residues (unless pretreated waste)
- In practice limited in the electrical efficiency to around 30%
- Generally surrounded by NIMBY
- Important with proper cleaning of flue gas and potential water effluents
- Large investments
- Partly renewable and partly fossil

Gasification of waste

- Potential to generate higher electrical efficiency - but that includes a complex gas cleaning
- Potential to generate liquid fuels as well as chemicals
- Technology under development, few commercially viable plants
- Need pre-treated waste
- Will generate residues
- Often a two-stage incineration process
- Partly renewable, and partly fossil
- Demands flue gas cleaning
- Large investment



Pyrolysis of waste

- Will generate syngas, oil and char- can be used for electricity generation or other use of the products (like black carbon or activated carbon)
- Upcoming technology
- Often modular and works in small scale
- Limited operational experiences in commercial applications
- Less economy of scale
- Partly renewable and partly fossil
- Will require flue gas treatment if products are burned to recover energy
- Require pre-treatment of the waste



Biochar plant in Stockholm (garden waste)

So what technology should I choose?

There is not one solution that fits all- the solutions need to be tailored according to needs and priorities, and as a part of an overall waste treatment strategy!

There are a number of different technologies available - with pros and cons. To work they need the proper policy/legislative framework.

All technologies needs proper operation/management and knowledge level- otherwise they will become more a risk than an asset.

When comparing technologies - find a common base to compare - otherwise you will be comparing apples and pears.

Thank you for your attention!

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