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Edison Explains

Waste to energy

Why have waste-to-energy systems become so popular?

Why do we need waste-to-energy systems?

The cross-currents of stricter environmental regulation, population growth and China's ban on the import of waste have shaped a need to turn waste products into energy.

According to the World Bank, around 3.40bn tons of waste will be produced globally per year by 2050, a 70% increase from 2016. At the same time, having levied taxes on landfill, Europe continues to put pressure on traditional disposal methods, including incinerators.

With regulatory restrictions throughout the developed world turning landfills into increasingly uneconomic ventures and the health implications of incinerators' dangerous pollutants receiving increased public pressure, new systems of waste management need to be developed such as waste-to-energy power plants.

Pollution and public pressure are also driving emerging economies to establish waste-to-energy systems. But here, where rapid urbanisation and population growth is also a significant factor, another layer of demand is added.

The World Bank forecasts that the average waste per day produced by one person in Eastern and Central Asia will grow from 1.1kg per day in 2012 to 1.5kg by 2025. This is the sharpest increase of any region, bar Latin America, with its 0.5kg increase. This is a stark contrast with OECD countries and their expected decrease of 0.1kg per person per day.

How do we turn waste into energy?

Waste-to-energy technology has been around since the 18th century, but only recently started to garner attention. The most used but least environmentally friendly method is incineration.

Unfortunately, many incineration plants do not generate electricity; instead, they inefficiently expend the waste's calorific content into the air. And those that do create impure products, unsuited for most tasks bar basic steam turbines.

Incinerators can also create toxic dioxins and furans, as well as other impurities such as tars, which must be filtered at great expense.

One of the preferred techniques involves creating biofuels, such as artificial syngas, or biodiesel. This is done through gasification or anaerobic digestion.

During gasification, heat is used to cook waste to produce syngas. In anaerobic digestion, syngas is also created but bacteria are the catalyst for synthesis.

The resulting syngas can then be burned to produce steam for turbines and used to make fertiliser or pure hydrogen, which is used in fuel cells.

Syngas can also produce methane or liquid fuel. Because the waste's carbon dioxide is already accounted for in the environment, the product is effectively carbon neutral.

What are some of the new waste-to-energy technologies?

There are a few up-and-coming waste-to-energy technologies with the potential to unseat gasification and anaerobic digestion as two of the leading waste-to-energy systems. One of the most discussed techniques is hydrothermal carbonisation.

This method creates hydro char, a substance with similar properties to fossil fuels.

There is also a new dendro liquid energy system, developed in Germany. The developers claim it is four times as efficient as anaerobic digestion. The Powerhouse Group has gone in a different direction with its DMG technology, creating a modular gasification system with the advantages of flexibility and a small scale.

A DMG module can be placed close to, or inside, existing waste processing facilities, reducing the cost of transport and carbon dioxide footprint. Powerhouse is in the middle of a, so far, successful pilot study.

Edison's Insight

'China's decision to stop importing waste materials from Europe for recycling has brought the problem of dealing with refuse into sharp focus. Waste-to-energy technology offers the potential for not only disposing of rubbish but using it to generate a green form of energy.' Anne Margaret Crow, Edison TMT analyst

How quickly is waste to energy being deployed?

In Europe and most developed countries, the push towards climate control, carbon

dioxide reduction and concerns over the supply security of gas are powerful motivators.

That said, in Asia waste to energy has really taken off, partly due to population growth. The World Bank claims urban population growth increased 7% in China, 5% in Indonesia and 4% in Vietnam over 2010–2016. Added to the effects of urbanisation and environmental concerns over air quality, particularly in China, waste to energy is a highly popular method of dealing with the growing amounts of refuse.

In China, waste-to-energy systems saw an annual average growth rate of 26% over the last five years, according to the International Energy Agency. Indonesia, Thailand, Pakistan and Vietnam together saw capacity grow by 16% annually over the same period.

Growth is also anticipated outside Asia, but at a slower rate. OECD countries' waste-to-energy capabilities expanded by 4% between 2010 and 2016.