The benefits of waste-to-energy technologies

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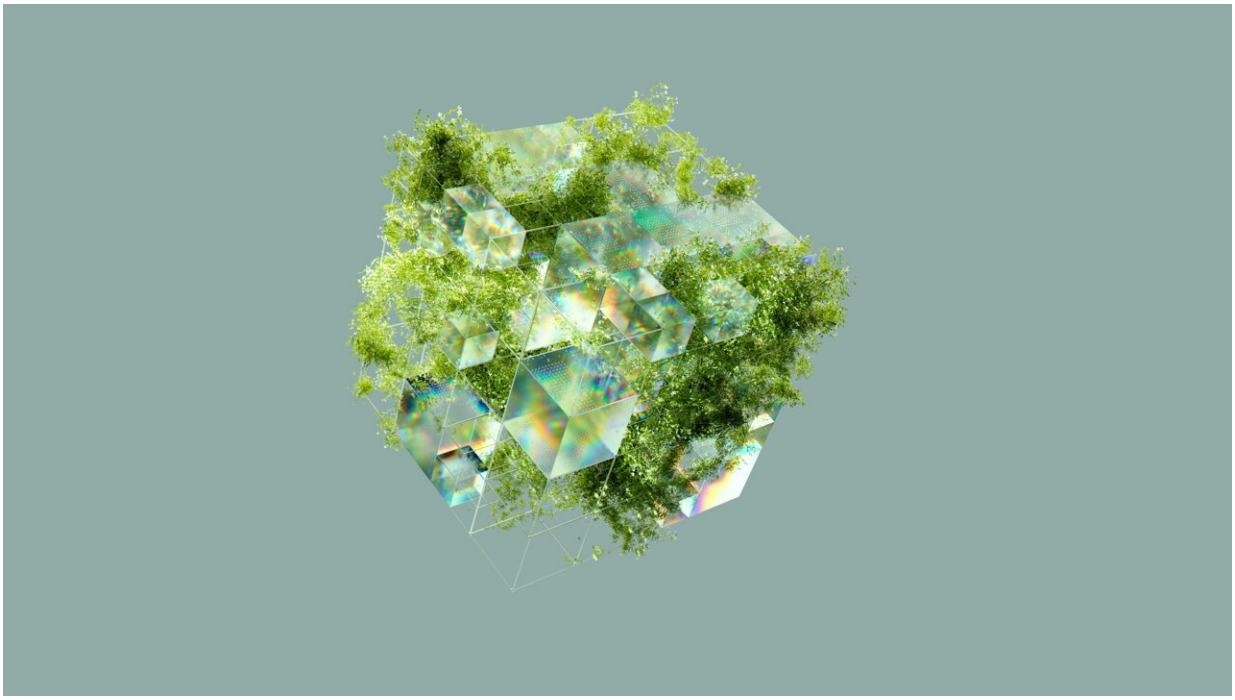

Credit: Google DeepMind from Pexels

Instead of hauling food waste to landfills, we might want to use that organic waste to power garbage trucks, your car, truck or SUV while at the same time potentially helping the environment.

Organic waste such as yard trimmings, paper, wood and food produces millions of tons of methane emissions at landfills every year in the U.S., but it could produce renewable natural gas and liquid fuels such as

gasoline and diesel, according to a study led by Uisung Lee of the Department of Energy's (DOE) Argonne National Laboratory. His paper, published in the *Journal of Cleaner Production*, helps assess the environmental benefits of various waste-to-energy production pathways while avoiding emissions of methane and other harmful air pollutants.

"Our study shows that using what would otherwise become landfill waste to produce fuel typically generates less greenhouse gases than simply letting the waste decompose," said Lee, a postdoctoral appointee in Argonne's Energy Systems Division.

This is because landfill gas from waste contains high concentrations of methane, which has about 30 times higher global warming impact compared to carbon dioxide. Although the operators of large landfills are required to combust landfill gas, it is impossible to perfectly collect the gas and there is still a large amount of non-captured methane escaping into the atmosphere.

Methods to produce fuel from municipal waste include biochemical, such as anaerobic digestion and fermentation, and thermochemical, such as hydrothermal liquefaction, pyrolysis and gasification. The resulting energy products include renewable natural gas, bio-char, bio-oil and hydrocarbon fuels (gasoline, diesel and jet fuel).

Fortunately, the supply of organic waste is abundant, according to Lee.

"By using waste to produce energy, we can avoid emissions from landfills and potentially reduce the need for additional landfills across the country," said Lee, adding that in 2014 we hauled an annual estimated 32 million metric tons of food waste resources to landfills, or about 70 trillion pounds of waste, according to the Department of Energy.

In 2015, the amount of greenhouse gases that escaped from landfills equaled almost 116 million metric tons of carbon dioxide, according to the Environmental Protection Agency. That has the same global warming potential as 29 million passenger cars that average 26 miles per gallon driven 12,000 miles per year, according to calculations by Lee based on statistics provided by the EPA.

Lee's study observed that we can collect waste feedstock using current infrastructure for collection and separation, which further lowers the cost of waste-derived energy. In addition, waste feedstocks are available at low or even negative prices if one considers tipping fees, according to a recent DOE report. (Tipping fees at landfills offset operating costs.)

The study also showed that converting waste to energy has environmental benefits compared to typical landfills that collect and combust landfill gas. Moreover, the environmental benefits are more significant when researchers apply the approach to waste that would otherwise be taken to smaller landfills that collect lower amounts of methane, releasing much of it instead, Lee said. He also noted that diverting and using wastes from smaller landfills could result in additional economic, logistical and operational challenges.

"These are the areas where we can realize the greatest environmental benefits while also producing transportation fuels," Lee said. Transportation fuels that displace fossil fuels can enhance energy independence and reduce fossil fuel use and greenhouse gas emissions, he added.

More information: Evaluation of landfill gas emissions from municipal solid waste landfills for the life-cycle analysis of waste-to-energy pathways. *Journal of Cleaner Production*. DOI: 10.1016/j.jclepro.2017.08.016

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