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How to Stop Humans From Filling the World With Trash

The future of garbage

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WHEN THE $20 BILLION HUDSON YARDS development is finished on Manhattan's Far West Side in 2024, it will have six skyscrapers, 5,000 apartments, more than 100 stores, and a public school. One thing it will not have is municipal garbage trucks.

Related Companies, one of the developers working on the project, plans to install pneumatic tubes that will whisk trash to a sorting area. The system should decrease the amount of garbage that ends up in landfills: residents will be able to drop recyclables and compost into designated chutes right outside their doors. By replacing trucks, the tubes will also cut down on noise and pollution—and, hopefully, on rats.

New York has experimented with pneumatic tubes before—the city's Roosevelt Island has used them for trash since the 1970s—but they may become more common as cities struggle with the acres of trash their residents create.

The average American produces about 130 pounds of trash a month, and an article in the journal *Nature* estimates that global solid-waste generation will triple, to 11 million tons a day, by 2100. Meanwhile, we're running out of space for landfills, especially in Japan and Europe. Here, drawn from interviews with scientists, environmentalists, and sanitation experts, are ideas for how to tackle this looming problem.

Putting a Price on Trash

One way to get people to produce less garbage is to charge them for it. So-called pay-as-you-throw programs—in which municipalities bill residents for their garbage—have been around for decades but are becoming more widespread. And they work: since beginning a pay-as-you-throw program in 1993, Worcester, Massachusetts, has seen a 53 percent drop in waste, from 43,000 tons a year to 20,000. "It really does change behavior," says Mark Dancy, the president of WasteZero, a company that runs similar programs in hundreds of municipalities. "Now that [people] are aware that trash has a cost, they begin looking for all the alternatives to putting things in a trash can."

Of course, people will try to cheat by putting their garbage in someone else's can. (Some towns employ inspectors to follow up on reports of illicit dumping; they search trash for identifying information and write tickets.) But technology could combat this, says Bryan Staley, the president of the Environmental Research and Education Foundation, which funds research on waste management. Companies could attach radio-frequency identification (RFID) tags—which cost as little as 7 cents apiece—on trash bags, he says, so that an RFID reader on a truck could reject any bags that don't belong to that household. RFID readers can also reward good behavior—a New Jersey trash-collection company called Sanico uses RFID chips on recycling bins to give people discounts when they recycle.

A Single Stream

Americans are pretty bad at composting and recycling: by some estimates, up to three-quarters of the material in U.S. landfills could have been diverted. Some experts think we should just collect everything—glass, paper, half-eaten Twinkies—in one bin and leave the messy work of sorting to robots. Certain municipalities that no longer require residents to separate paper from plastic and so forth already use machines to do much of this work. Eventually, Staley says, technology akin to facial-recognition software could further automate sorting by helping machines distinguish, say, a peanut-butter sandwich from a peanut-butter jar and send them along for composting and recycling, respectively. "You in essence remove this element of human behavior that requires people to make a decision about whether to throw something in the bin," Staley says.

Skyscrapers Made of Garbage

We already turn water bottles into fleece, plastic bags into deck material, roofing into pavement. But ideas abound for more-futuristic forms of

recycling. Mitchell Joachim, a co-founder of Terreform ONE, a design firm based in New York, proposes crushing trash and molding it into Tetris–esque blocks that we could use to build islands and skyscrapers. Joachim's firm has created architectural plans for a 53-story tower made with the waste New Yorkers produce in 24 hours. A group in Guatemala called Pura Vida is already working on a low-tech version of the same idea; it promotes the use of a building material it calls an "eco-block"—just a plastic bottle stuffed with trash—that it says makes for excellent insulation and is safe in earthquakes.

Smarter Leftovers

Food accounts for about one-fifth of what goes into municipal landfills, and companies are looking for new ways to repurpose what we don't eat. Some farmers use leftovers to feed their animals, and companies in California and Ireland are turning edible trash into pet food. Better systems to collect and distribute excess food from grocery stores and restaurants could help feed the hungry. Such food recycling is difficult and labor-intensive because it has to be done very quickly, but as droughts challenge agricultural production around the world, it could become more common.

Garbage Power

Food can also be turned into fuel through anaerobic digestion, a natural process during which microbes break down organic matter in the absence of oxygen. Farmers have used this process for years to make biogas out of manure; now new machines can speed things up. Anaerobic-digestion facilities are expensive to build, but they can be profitable if companies have a steady supply of food waste, as they would in the growing number of cities and states that have banned restaurants and grocery stores from

sending large amounts of leftovers to landfills. Someday, businesses could build their own digesters, says Thomas DiStefano, a civil and environmental engineer at Bucknell University. Michigan State University has two such digesters that turn food waste from dining halls into electricity for the campus.

Burning garbage is another way to turn trash into fuel (usually by making steam, which turns turbines). The first trash incinerator in the U.S. was built in 1885, and until the 1980s, we burned much of the waste we couldn't (or didn't) recycle. But scientists discovered that dioxin emissions from incineration plants caused cancer and birth defects. The technology has since improved, and today's plants are so clean that in Europe, builders are putting them in the middle of cities so they can power nearby households. In Copenhagen, a ski slope will be built atop one.

Plasma gasification, an experimental technique, could eventually replace incineration as an even cleaner and more efficient way to get rid of trash, says Juliette Spertus, an architect who has studied waste management. The process involves heating waste under pressure to produce syngas, a substance that can be used to make liquid fuels and other chemicals. Another process, called pyrolysis, also uses heat to turn trash into fuel. Both techniques are currently expensive and can process only small amounts of waste at a time, but they could become viable as space in landfills becomes increasingly scarce.

Ending Trash for Good

If rocket technologies improve, Staley says, we might one day blast trash into space and use the sun's heat to burn it. But given that our planet has limited resources, burning them after one use probably isn't the answer. Some environmentalists want to prevent companies from making

nonrecyclable materials in the first place, and a few have suggested alternatives. A European research group called ZeroWIN, for example, designed a laptop made of recycled materials whose components can be reused. (Most computers end up in landfills, potentially leaking chemicals into the ground.) Joachim, of Terreform ONE, says the planned obsolescence of products should be outlawed. So-called extended-producer-responsibility laws could require manufacturers to fund and manage the recycling of their goods so that the private sector, rather than the public, is responsible for products at the end of their life, giving companies an incentive to make their products last longer. The beginning of the cycle, not the end, might be when we can most effectively eliminate trash.

A Brief Chronicle of Garbage

1934: The Supreme Court bans cities from dumping garbage into the ocean.

1905: One of the first incinerators in the U.S. begins powering the lights on New York's Williamsburg Bridge.

3000 B.C.: The earliest recorded landfill is built on the island of Crete.

1942: The War Production Board urges Americans to conserve resources with its "Get in the Scrap!" campaign.

1973: The nation's first curbside recycling program is introduced in Berkeley, California.

2002: Ireland becomes the first country to impose a tax on plastic shopping bags.

2150: The U.S. recycles or composts 100 percent of its trash.

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