

U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**



Whether from the trash can, the toilet, or the farm, it's tough to manage waste to benefit both people and the planet. More well-known waste management options include reducing waste, reuse, recycling, composting, and sending waste to landfills. **Do you know about other options for managing waste?**

Learn how the U.S. Department of Energy Bioenergy Technologies Office is transforming trash into fuels and products with a cleaner environmental footprint. Here are five fun facts you may not know about waste.

For more information, visit: energy.gov/bioenergy

5 FUN FACTS ABOUT WASTE



1 Your poop can take you places

You rid your body of waste every time you go to the bathroom. It's your body's way of eliminating materials and minerals that aren't useful to you. When you flush the toilet, what goes down the pipe is considered "wastewater" (literally, water with waste in it). Wastewater then goes to a place called a "**resource recovery facility**," where the waste is filtered out of the water for reuse again.

But what happens to all the waste that's removed? Soon, it could be turned into biofuels. Researchers are creating ways to convert wastewater solids into biofuels that can power cars, trucks, ships, and airplanes. Seriously, your poop really could take you places.



2 Expanding what can be recycled

It's true we should **reduce, reuse, and recycle** whenever we can. But some everyday products can't be recycled today simply because of how they are made—with different materials stuck together. For example, your disposable cup from the coffee shop has paper on the outside. But the inside is coated with a waxy plastic to keep the paper dry. These cups cannot usually be recycled because a machine can't pull the two materials apart. The good news: That doesn't mean your coffee cup must

lose its value as soon as you finish your brew. Scientists are creating a process using heat and chemicals to break down the individual parts of non-recyclable items like coffee cups.

These technologies separate the paper from the waxy plastic and use them to make power, specifically biofuels. This research could turn the garbage in your bin into energy that powers your car or home.



3 Different places = different wastes = different resources

There are many differences between living in the city and the country. That means the waste from these places tends to look a lot different, too. With many more people, cities create more food scraps than small rural towns. But out in the country, there is more animal waste like manure because of numerous farms.

These different places produce different wastes—and both can be used to make valuable resources. Both manure and food scraps are "**organic wastes**," or leftovers from plants and animals that break down over time. These can be turned into useful resources with different values:

- **Manure**—can be used as a fertilizer for plants and crops for food, fuel, and fiber.
- **Food Scraps**—release gases as they decompose (break down) that can be burned to create energy.



TRANSFORMING WASTE

DID YOU KNOW?

Food waste, household garbage, and exhaust are different types of wastes that could be turned into biofuels; plastics, chemicals and other products; or heat and electricity. These waste streams are available without much change to how society uses land, and in many cases, using waste helps address unique and local challenges of disposing it.



4 Turning waste into energy is twice as nice

Burning fossil fuels for energy is not the only way we create planet-warming greenhouse gases. Once in a landfill, your trash breaks down—very slowly—releasing an especially harmful gas called methane that wreaks havoc on our planet’s climate. So what if we could capture that methane and turn it into energy before it even reaches the atmosphere? With some technologies, we can do that. For example, we can capture landfill gases and use them to create heat for your home instead of **fossil fuels**. Think of the benefits:

- No methane goes into the atmosphere from the landfill
- Fewer greenhouse gases are released from burning renewable gases instead of coal.



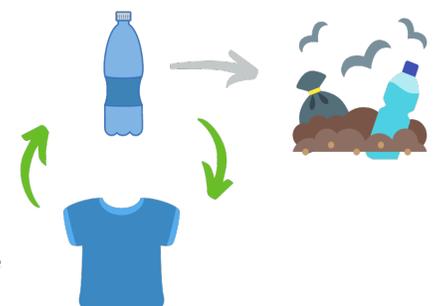
Two problems, one solution, two benefits! Some resource or energy recovery strategies like this can prevent other environmental harms like foul-smelling odors or water pollution. However, no technology is a perfect solution, so we must weigh the potential good and bad impacts of different management options on local communities.

5 The life of your water bottle doesn’t have to end in a landfill

Everything has a “**life cycle**”: including items that we use every day like our clothes, electronics, and plastic products. A product’s life cycle starts when the materials it’s made from are taken from the earth. It ends when the product loses its value and is thrown away. Think about the short life of a plastic water bottle:

1. Petroleum is pumped from the earth and turned into a plastic bottle at a factory.
2. A company fills it with water and ships it to the grocery.
3. We buy it, drink our fill, and often toss it in the trash.

Why limit its life to such a short, single use? Recycling plastic water bottles can give them many more lives. Their plastic gets shredded and spun into thread to make t-shirts or carpets. That way, its life isn’t destined to end in a landfill. Recycling can make useful products again and again.



RESOURCES RESOURCES

Words to Know

Bioenergy: Energy produced from biomass.

When you see “bio-“ in front of fuels, products, and power, it means these were made from biomass instead of petroleum.

Bioeconomy: A global transition to the sustainable use of renewable biomass resources in energy and products aiming to increase economic, environmental, and social benefits and reduce environmental and social harm.

Biofuels: Liquid or gaseous fuels derived from bioenergy feedstocks. Examples include ethanol, methanol, methane, and hydrogen.

Biomass: An energy resource derived from

plant material. It includes agricultural residues (leftovers), forest residues, purpose-grown energy crops (such as algae and some kinds of grasses), urban wood waste, and food waste.

Composting: A natural process of turning organic waste like leaves and food scraps into a beneficial fertilizer that may benefit both soil and plants.

Fossil Fuels: Non-renewable energy resources including oil, coal, and natural gas.

Greenhouse Gases: These gases make Earth warmer and throw off the energy balance of the planet.

Life Cycle: The different stages of life that an organism/product goes through.

Resource or Energy Recovery: The stage of the waste management hierarchy that aims to recover useful benefits from non-recycled waste, to be used as a resource for creating fertilizer or energy for vehicles and buildings.

Resource Recovery Facility (RRF): A place where waste is collected and processed to recycle, send to a landfill, or create fuels and power. A specific type of RRF is a wastewater treatment facility, which cleans water by separating out waste.

Wastewater: Water that has been used in a home, a business, or for construction. Also known as sewage.

Operation BioenergizeME

Are you someone with passion for science, technology, or the environment?

The U.S. Department of Energy Bioenergy Technologies Office can help you learn about bioenergy and how you could help grow the bioeconomy! Through Operation BioenergizeME, you will be able to learn more fun facts about bioenergy, do cool bioenergy experiments in your classroom, and learn about renewable energy career opportunities in the bioenergy industry. If you are interested in:

- Communications, education, and outreach
- Engineering and manufacturing
- Agriculture, life, and physical sciences
- Operations, management, and business infrastructure

The bioenergy industry has a place for you! To learn about opportunities, visit: energy.gov/eere/bioenergy/stem-and-operation-bioenergizeme



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DOE/EE-2642 • February 2023