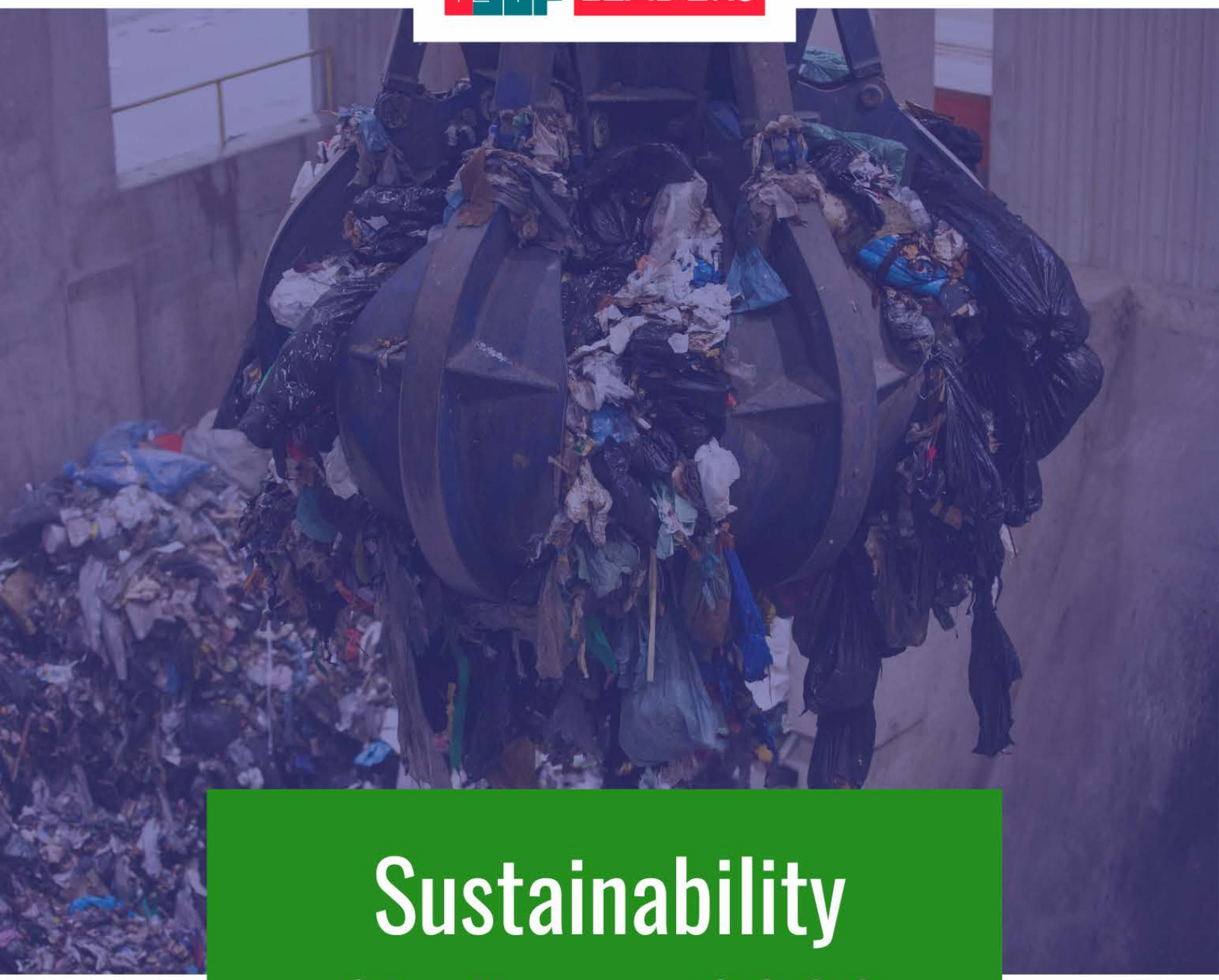
LEADERS



Sustainability Challenge 2026

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The Sustainability Challenge is a hands-on, team-based event hosted at Catholic University's **College of Engineering, Physics, and Computing**, where mixed-school groups of will tackle the Challenge Task, based on a real-world case study developed by SGAP Leaders experts and REWORLD. Students will do research and collaborate on a proposal to present their strategies using campus computers or personal laptops. Teams present to subject matter experts, receive feedback, and top-scoring groups earn awards such as job shadowing, internships, or apprenticeships

WASTE TO ENERGY BASICS AND TECHNOLOGIES

Basics

The term municipal solid waste, or MSW, refers to all the material people throw away. This category covers a wide range of materials, including: food, yard waste, paper, plastic, textiles, metals and wood.

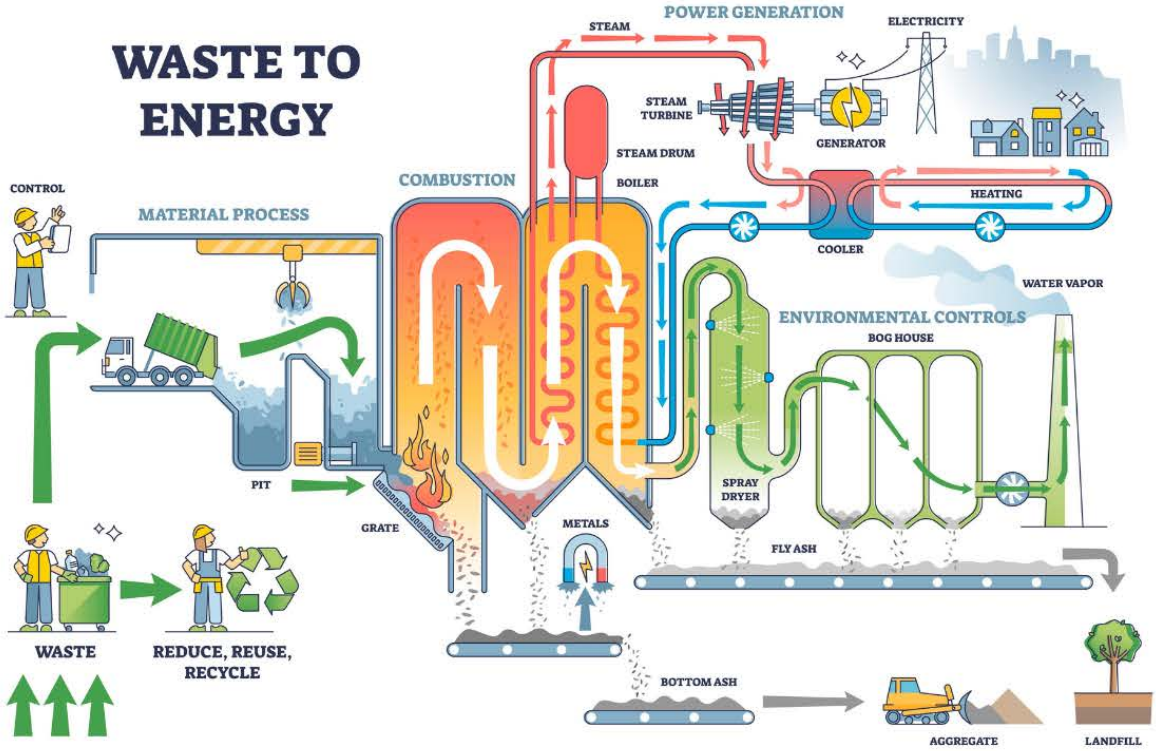
Many of these materials are organic matter, or biomass. They contain the embodied energy of the plants and animals that they are made from. Other materials, such as plastics, are not organic but still contain stored energy.

Technologies

Waste-to-energy (WTE) technology converts waste into usable energy, primarily electricity, through processes like combustion, incineration, gasification, pyrolysis and anaerobic digestion.

Combustion is the general chemical process of burning waste to produce energy. Incineration involves burning waste at high temperatures to create steam that drives a turbine generator, while gasification uses a low-oxygen environment to produce a syngas fuel. Anaerobic digestion uses microorganisms to break down organic waste, producing biogas while pyrolysis heats waste in a low-oxygen or no oxygen environment to convert it into high-quality fuels, such as diesel. Incineration is the most common method.

More specifically, combustion is the general chemical process of burning, while incineration is a specific application of controlled combustion for destroying waste at high temperatures. The key difference is that combustion is a chemical reaction of a substance with an oxidant (usually oxygen) to produce heat and light, whereas incineration uses combustion to reduce the volume of waste and destroy harmful organic constituents in a controlled environment.



Note: Water will be required to produce the steam generated with any WTE technologies.NBC News video

Water Energy Nexus

The water-energy nexus is the interlinked relationship between water and energy where water is needed to produce energy and energy is used to supply and treat water. This connection means that actions in one sector have significant impacts on the other, and managing them together is crucial for resource conservation, climate change mitigation, and sustainable development. For example, energy is used to pump and treat water as part of the waste water treatment process while energy production (like thermoelectric and hydropower) requires large amounts of water for operations and cooling.

The technologies used to achieve the clean energy transition could increase water stress or be limited by it. Some low-carbon technologies, such as wind and solar PV require very little water, others, such as biofuels, concentrating solar power (CSP), carbon capture, utilization and storage or nuclear power uses relatively more water.

Key Data & Context for Case Challenge

- According to the U.S. Environmental Protection Agency (EPA), in 2018 about 292.4 million short tons of MSW ere generated in the U.S. (≈ 4.9 lbs/person/day).
- Of that, about 34.6 million tons were combusted with energy recovery.
- EfW and waste-to-energy plants reduce waste volume by roughly 85-90% (for example, 2,000 lbs MSW may convert to 300-600 lbs ash).
- Industry sources note that new MSW combustion plants typically cost at least $100 million to build, with many larger plants costing double or more.
- The U.S. municipal solid waste management market was valued at about US$17.1 billion in 2024, with a projected CAGR[2] of ~2% from 2025-2034.

[2]CAGR, or Compound Annual Growth Rate, is a financial metric that represents the average annual growth rate of an investment over a specified period, assuming the profits are reinvested each year. It provides a "smoothed" rate of return, making it easier to compare different investments over time by eliminating the effect of volatility. CAGR is calculated using the investment's beginning value, ending value, and the number of years in the period.

Facility Economics (Assumptions)

Proposed installation cost: **$186 million**
ASSUME the facility will accept MSW and produce electricity and metals-recovery revenue.

Suppose each ton of MSW yields:

- 565 kWh of electricity (as applied in the original Montgomery case)
- Electricity sold to wholesaler at US$35 per MWh (i.e., US$0.035 per kWh)
- Operational cost assumed at US$27 per ton of MSW (as per the original facility)
- Suppose tipping fee revenue from MSW is US$56 per ton (as prior Montgomery example)
- Suppose the ash disposal cost is US$42 per ton of ash (again based on prior data)
- Suppose that one ton of MSW is reduced by ~75% in weight (and ~90% in volume) to ash.

[3]GHG= greenhouse gases