



Prize Winner

Science Writing

Year 3 - 4

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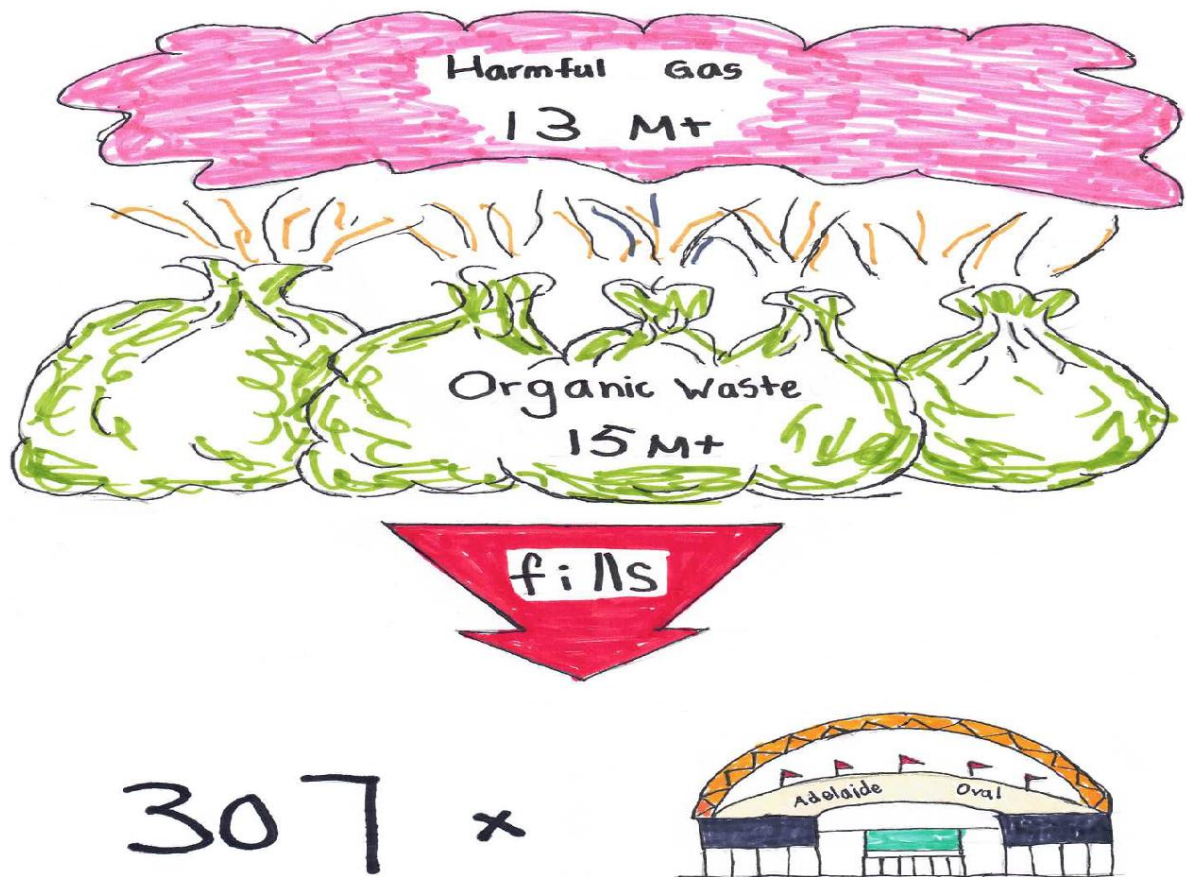
FROM TRASH TO TREASURE -

How to turn organic waste into treasure?

Introduction

Our planet is under pressure. People are using natural resources faster than Earth can replace them. We also make a lot of waste.

In Australia, we make about 15 million tonnes of organic waste each year which fills nearly 307 Adelaide ovals. This includes food waste and waste from farms, forests and fishing. Almost 40% still goes to landfill where it can make harmful gases.



We need to do something about it and seek ways to build a better world by turning organic wastes into treasures!

What is organic waste?

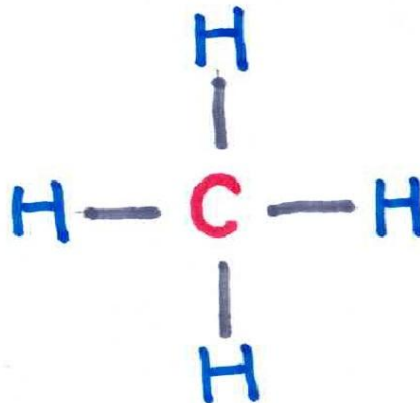
Organic waste is waste that comes from plants or animals. It can break down naturally. Examples include animal manure, food scraps, garden waste and wood waste.



Why Organic waste is a serious problem to our Earth?

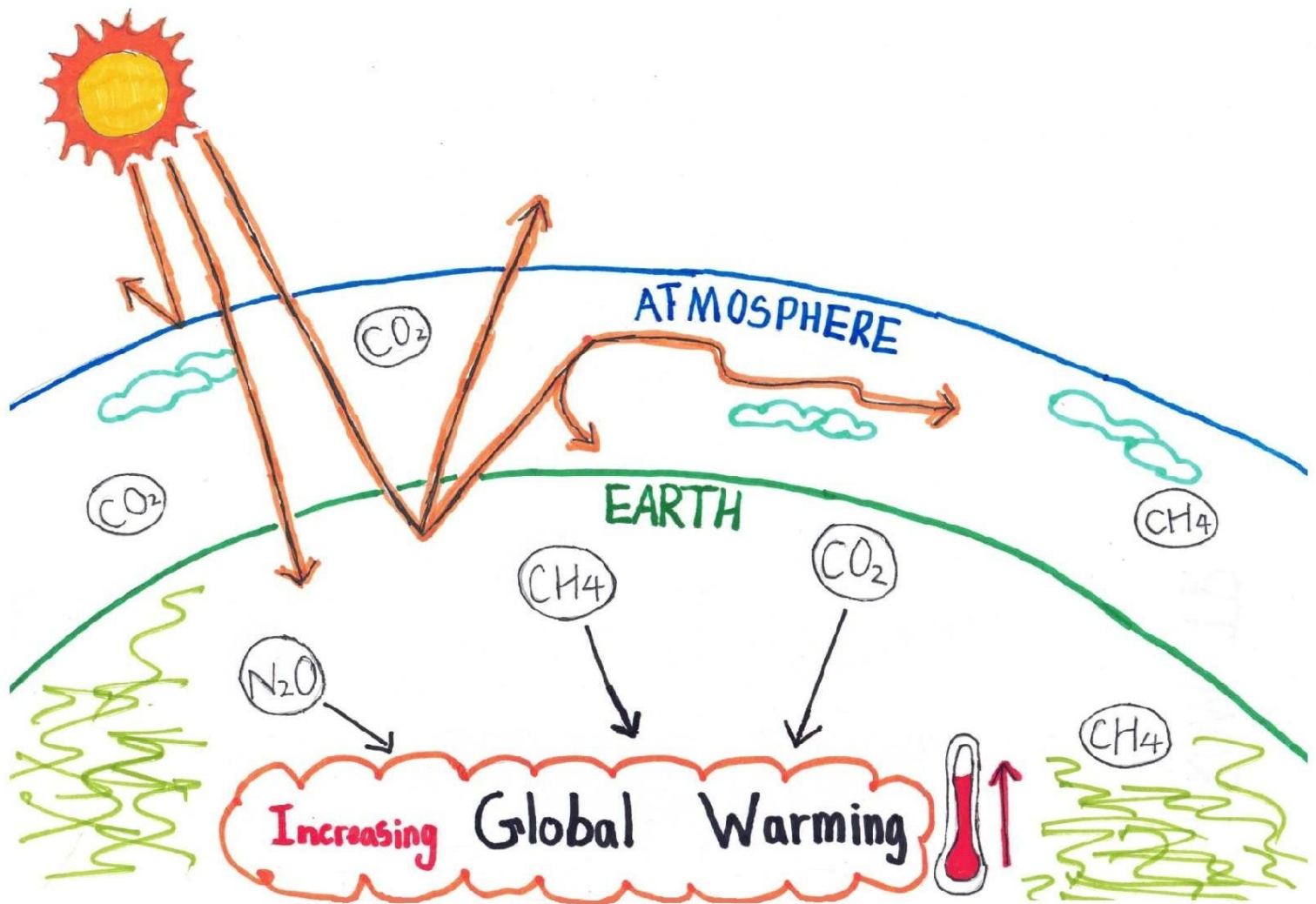
Organic waste breaks down with help from tiny living things called microorganisms. If organic wastes go to landfill, they can break down and make Carbon Dioxide (CO_2) and Methane (CH_4) gases.

Methane (CH_4) is a gas with no colour or smell that can catch fire easily.



The greenhouse effect helps keep Earth warm enough for life. Greenhouse gases (Carbon dioxide (CO_2), Methane (CH_4) and nitrous oxide (N_2O)) change how much heat is absorbed by Earth's atmosphere.

Methane is responsible for approximately 30% of Earth's current net warming and traps heat in the atmosphere 25 times more than Carbon dioxide (CO_2). Too much greenhouse gas traps extra heat in the air and adds to climate change on Earth.



Inspired by NSW Government: What are greenhouse gases website

How to turn organic waste into treasure?

TREASURE often refers to a collection of valuable items, such as money or jewels. It can also describe anything highly valued or cherished.

Organic Fertiliser is treasure for farmers!

Farming is important in Australia because it produces food and other natural products. In 2024-2025, agriculture, fisheries and forestry were worth \$100.3 billion. Australia also sold \$75.8 billion of these products to other countries.

Organic fertiliser can be a "treasure" for farms because it helps soil and plants. Organic waste, such as animal manure and fruit or vegetable scraps, can break down through decomposition or anaerobic digestion. During these processes, microorganisms break the waste into smaller parts and release nutrients into the soil. The main plant nutrients are Nitrogen (N) Phosphorus (P) and Potassium (K). Plants use these nutrients to grow healthy leaves, strong roots, flowers and fruits.



N

Good for
green leaves



P

Good for
strong roots
and flowers



K

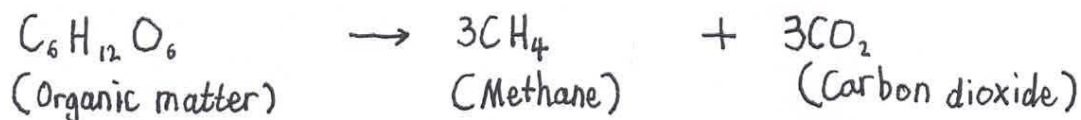
Good for
fruits and
vegetables

Renewable Energy is valuable as treasure!

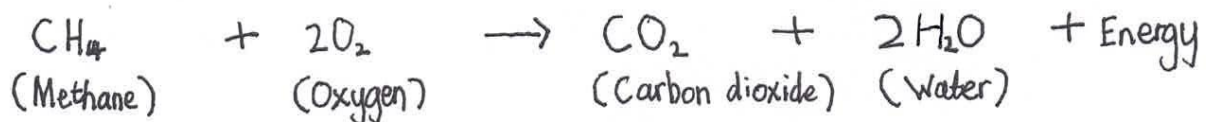
Energy is not a physical "treasure" but it is highly valuable to us because we cannot survive without energy!

As organic waste decomposes in a process called anaerobic digestion, organic molecules break down and release energy known as biogas. Biogas contains roughly 50-70% Methane (CH_4), 30-40% Carbon dioxide (CO_2), and trace amounts of other gases.

The overall simplified creation chemical equation of Biogas is

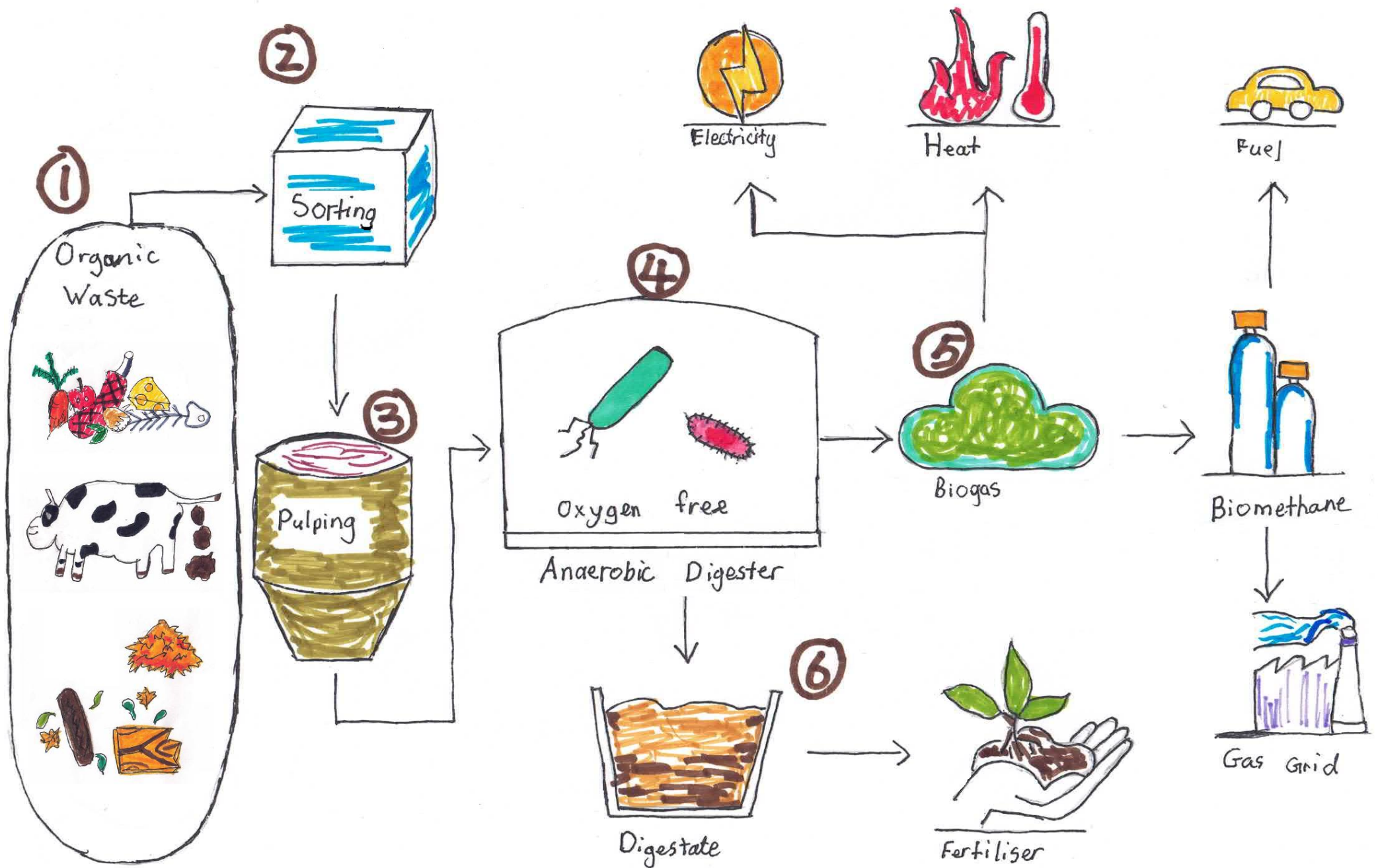


When biogas is burned as an energy source, the methane reacts with oxygen. The chemical formula for burning methane, which turns the biogas into thermal and mechanical energy, is



How the process works

1. Collection: Gather organic waste and send to processing facility.
2. Sorting: Remove any packaging or non food items.
3. Pulping: Chop the organic waste into small pieces and mix with water to form a thick liquid.
4. Digestion: The thick liquid goes into the digester tank where tiny, oxygen-free microorganisms eat the waste.
5. Energy creation: As the organic waste breaks down, it releases a gas called biogas. Biogas can be used through:
 - A) Direct Heat: Connect biogas directly to a stove or heater for cooking and warming.
 - B) Electricity: Feed biogas into converted generator to produce electrical power.
 - C) Upgrading: Filter out Carbon dioxide (CO_2) to create pure biomethane, which acts like natural gas.
6. Fertiliser: Leftover solid material from the tanks is used to create nutrient-rich fertiliser for farms.



Benefits for turning Organic waste into renewable energy and valuable soil products

- Better Soil: Organic soil products add nutrients and organic matter to the soil. This helps plants grow and reduce the need for chemical fertilisers.
- Renewable Energy: Biogas can be used to make electricity, heat, vehicle fuel or renewable natural gas. This means we can use less coal and natural gas.
- Less Methane (CH_4) in the air: Biogas contains Methane (CH_4). If Methane is captured and used for energy, less of it escapes into the atmosphere. This can help reduce greenhouse effect.

Conclusion

About 77% of Australians use Council kerbside bin services for organic waste. These services help keep organic waste out of landfill, reducing Methane gas released into Earth's atmosphere.

- Garden Organics (GO): A bin for garden waste, such as leaves, grass clippings and branches.
- Food Organics and Garden Organics (FOGO): A bin for food scraps and garden waste together.

In Australia, governments and energy companies are studying ways to turn organic waste into renewable energy. Other countries, such as Denmark

and Germany, already use large biogas facilities to do this.

By using science and technology, instead of throwing away 15 million tonnes of organic waste to landfill every year, we can turn them into "treasure".

Word count: 809

References:

- [Australian Government – Department of Climate Change, Energy, the Environment and Water \(DCCEEW\)](#)
- [Clean Up Australia: The issue with food waste](#)
- [Australian Farm Waste Portal: Organic Waste](#)
- [Wikipedia: Methane](#)
- [NSW Government: What are Greenhouse Gases \(GHGs\)](#)
- [Agriculture Victoria: Greenhouse Gas Cycles in Agriculture](#)
- [Australian Government – Department of Agriculture, Fisheries and Forestry \(ABARES\): Snapshot of Australian Agriculture 2026](#)
- [AGL: Sustainable Business: How Biogas is Turning Waste into Power](#)
- [Science NASA: The Causes of Climate Change](#)
- [United Nations: Climate Action - Causes and Effects of Climate Change](#)
- [Biogas from Wastewater: A Sustainable Energy Solution](#)
- [HomeBiogas: Biogas Composition - Fact Sheets & Characteristics](#)
- [End Food Waste Australia: Waste-to-Energy: Fuelling Sustainable Wastewater Treatment with Food Waste](#)
- [Environment and Energy Study Institute: Fact Sheet - Biogas: Converting Waste to Energy](#)
- [Yarra Valley Water Australia: Food Waste to Energy](#)
- [How Biogas Generates Electricity: Anaerobic Digestion to Generator Output](#)

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