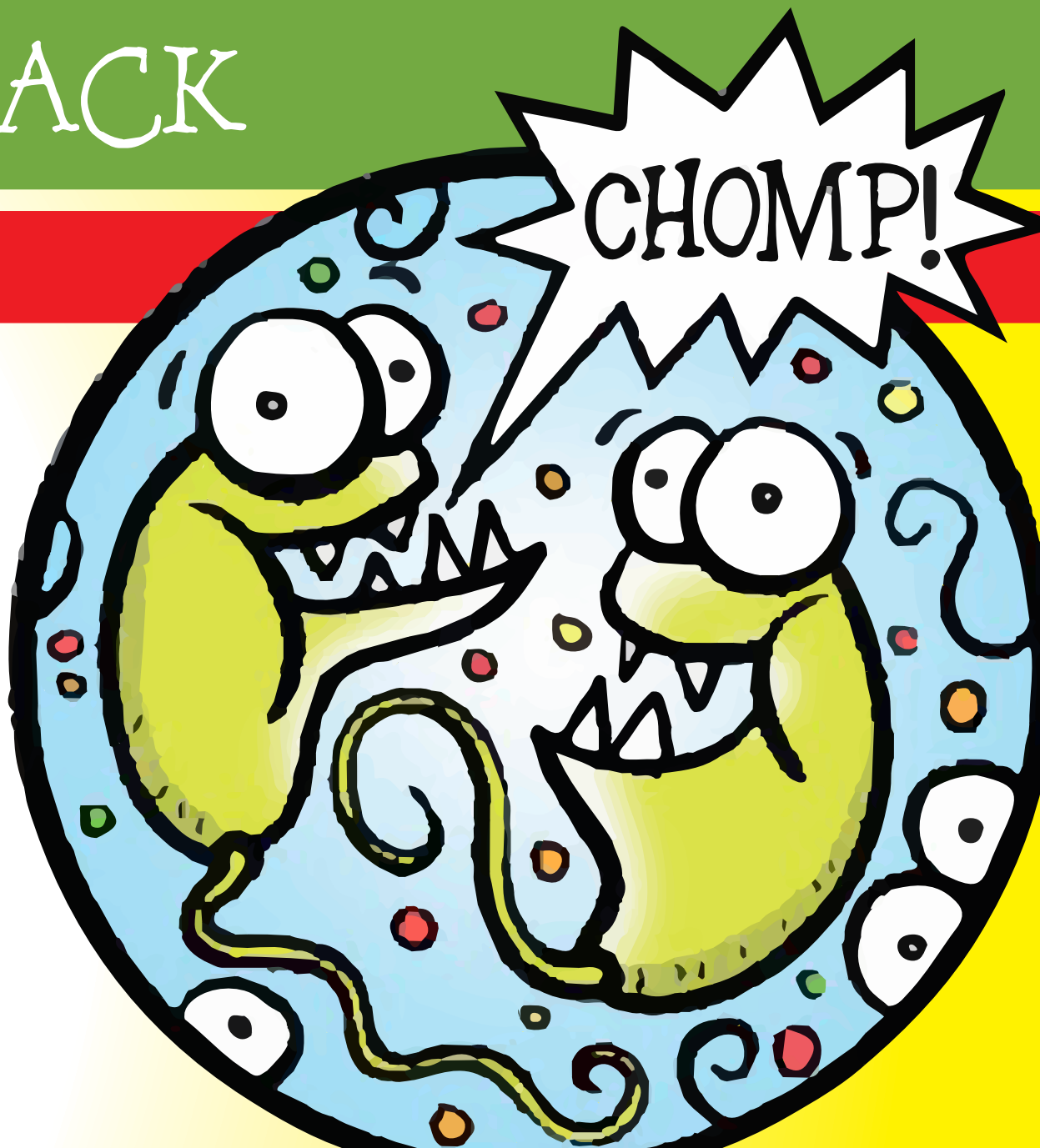
FOOD WASTE EDUCATION PACK

FOR KEY STAGE 2



with

HORRIBLE SCIENCE™

BURPING BACTERIA

worksheet

Somerset Waste Partnership

Carymoor Environmental Trust

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Food Waste Education Pack

Contents

This pack has been written and developed by Carymoor Environmental Trust. The Horrible Science™ worksheets on Burping Bacteria are by Nick Arnold and Tony De Saulles. The pack and worksheets were commissioned by Somerset Waste Partnership.

Carymoor pack written by Beth Coleman, Rupert Farthing and Frances Stuart.

Illustrations by Rupert Farthing. Copyright 2013. Information correct as of April 2013.

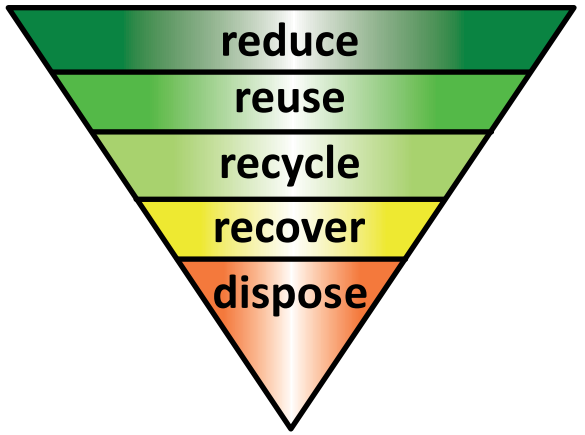
Somerset Waste Partnership

Carymoor Environmental Trust

Viridor Transforming waste™

Introduction

Welcome to Somerset's own Food Waste education pack for **Key Stage 2**. This pack provides a range of ideas and resources to help teach about the food waste issue and ways in which we can help to reduce the amount of food that is sent to landfill. The way we consume resources is under increasing pressure and according to Friends of the Earth a third of our impact on the climate comes from the way our food is grown, processed and transported. With the United Nations projecting that the world population will increase from 7 to 9 billion by 2050 there is a clear need for all of us to reduce waste and adopt more sustainable lifestyles.



The pack aims to inspire action in schools through the waste hierarchy (as pictured) with Reduce (avoiding making the food waste in the first place) being the best option through to disposal at landfill being the least preferred option.

The pack has been prompted by the exciting development of a new **anaerobic digestion plant** in Somerset which will take householders' food waste from the kerbside and convert it into energy and compost.

In this pack we look at the wider environmental impacts of food production, ways to reduce food waste and how we can best use any waste that might be left over.

Somerset has made significant steps forward with food waste in recent years with a kerbside collection service for householders for food and dry recyclables. Schools now have a range of recycling services available to them, including for food waste, and nearly all the schools in Somerset compost some of their organic waste from their garden and fruit waste from snacks.

The pack provides contact details to help your school with any issues you might have in this area and we hope will inspire the children to get involved and take action against food waste themselves.

Illustration of the new anaerobic digestion plant at Walpole, near Bridgwater in Somerset.

How to use this pack

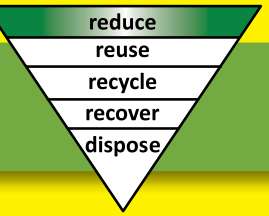
This pack contains a mixture of lesson plans, pupil's resources and supporting background information sheets. The lessons can be used as stand-alone activities or the pack can be used as a whole to deliver a more comprehensive cross-curricular topic. An introductory PowerPoint presentation is available and can be downloaded from the education pages of **www.carymoor.org.uk** that sets the scene for the sessions that follow and which could be used as an assembly should more than one class be working through the pack at the same time. Each lesson plan lists the potential curriculum coverage, key vocabulary and resources needed. There are also comprehensive links to other resources and materials and suggestions for extension activities and follow-up work. The supporting background sheets and appendices are designed to give teachers a more in depth understanding of the subject but could equally well be used as sources of additional information for pupils. The links and ideas contained within these sheets also act as signposts should teachers wish to broaden their delivery to include other related environmental issues.

Curriculum Links

Subject Area	Curriculum Content	Activity
English	En1: Speaking, listening, group discussion and interaction, drama. En3: Writing – composition, planning and drafting.	'Fruit Trumps', 'Pizza Processes', 'Debate and Role Play' and 'Plenary Session' 'Plenary Session'
Maths	Ma2: Number Solving numerical problems 4a: choose, use and combine any of the four number operations to solve word problems involving numbers in 'real life', money or measures of length, mass, capacity or time, then perimeter and area Ma4: handling Data 2a: solve problems involving data 2b: interpret tables, lists and charts used in everyday life	'Fruit Trumps'
Science	SC2 Life Processes and Living Things: 1a: that the life processes common to humans and other animals include nutrition. 1c: to make links between life processes in familiar animals and plants and the environments in which they are found. 5f: that micro-organisms are living organisms that are often too small to be seen, and that they may be beneficial [for example, in the breakdown of waste] or harmful.	'What does an anaerobic digester do?'

Subject Area	Curriculum Content	Activity
Geography	1a: ask geographical questions 2c: use atlases, globes, maps and plans at a range of scales 2d: to use secondary sources of information, including aerial photographs. 2g: decision-making skills 4b: recognise some physical and human processes and explain how these can cause changes in place and environments. 5a: recognise how people can improve the environment or damage it and how decisions about places and environments affect the future quality of people's lives. 5b: recognise how and why people may seek to manage environments sustainably, and to identify opportunities for their own involvement. 1d: Identify and explain different views that people, including themselves, hold about topical geographical issues. 3e: to identify how and why places change and how they may change in the future. Knowledge and understanding of environmental change and sustainable development. 6e: an environmental issue caused by change in an environment and attempts to manage the environment sustainably.	'Fruit Trumps' and 'Pizza Processes' 'Fruit Trumps' and 'Pizza Processes', 'What does an anaerobic digester do?' and 'Debate and Role Play' 'Debate and Role Play'
Citizenship	1a: talk and write about their opinions, and explain their views, on issues that affect themselves and society. 2a: to research, discuss and debate topical issues, problems and events. 2j: that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment. 4: Developing good relationships and respecting the differences between people	'Fruit Trumps', 'Pizza Processes', 'Debate and Role Play' and 'Plenary Session'
ICT	1a: to talk about what information they need and how they can find and use it [for example, searching the internet or a CD-ROM, using printed material, asking people]. 2a: how to develop and refine ideas by bringing together, organising and reorganising text, tables, images and sound as appropriate 3a: how to share and exchange information in a variety of forms [for example, displays, posters, animations, musical compositions] 3b: to be sensitive to the needs of the audience and think carefully about the content and quality when communicating information	'Pizza Processes' 'Plenary Session'

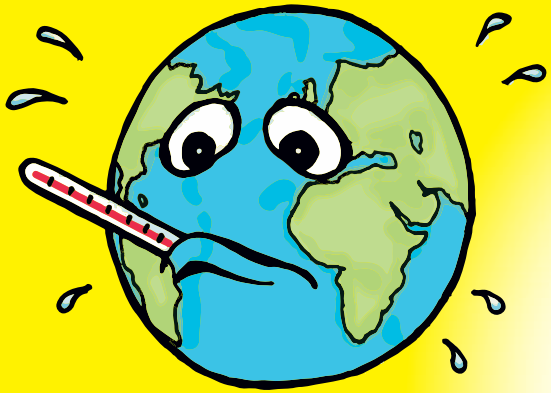
WHY DO WE WASTE SO MUCH FOOD?



Throwing away food is a waste in lots of different ways. We spend £12 billion a year on throwing away edible food! That's an average of **£50 per family per month!** (source: Love Food Hate Waste) But the cost is not just to our wallets, wasting food has huge costs for the environment too!

If food waste is buried amongst other rubbish in a landfill site bacteria feed on the food helping it to rot. These bacteria produce a gas called methane. Methane is a greenhouse gas similar to carbon dioxide, but is at least **25 times** more damaging than carbon dioxide in its effects on our planet in the form of **climate change**.

More methane gas in the blanket of gases around our world, traps more heat and stops it escaping to space, leading to global warming and climate change. Climate change can cause polar ice-caps to melt and sea levels to rise and can also affect our climate: bringing more extreme weather patterns such as storms, flooding and drought.



If no food went to landfill sites in the UK, the equivalent of at least **20 million tonnes** of carbon dioxide would be saved from entering our atmosphere: That is like taking one in every four cars off our roads! (source: Love Food Hate Waste) On top of this, when we throw away edible food we also waste all of the natural resources, energy and labour involved in producing, storing, transporting and cooking that food in the first place.

Wasting edible food also wastes:

- the embedded energy from growing, transporting, storing and preparing food
- the money spent on buying and preparing the food
- the money it costs to dispose of the waste
- the nutritional benefit of the wasted food

The Good News

Between 2006/07 and 2010 the amount of food wasted in the UK **reduced** by around 13%, which is over 1 million tonnes...this amount of food would fill Wembley stadium!

Fascinating Food Facts

In the UK we throw away **7.2 million tonnes** of food and drink from our homes every year! Around **5.3 million** tonnes of this is food that could have been eaten!

(source: Love Food Hate Waste website)

Fruit Trumps lesson plan

Learning Outcomes:

- An understanding of where in the world our food comes from.
- An understanding of the resources consumed to supply us with food (e.g. fuel, energy, packaging materials).
- An appreciation of local and seasonal food.

Fascinating Food Facts!

'For every 10 pieces of fruit we eat in the UK, 9 have been grown in other countries!' (source: Food for Life One Planet Food teachers activity pack)

National Curriculum Links:

English:
En1: Speaking, listening, group discussion and interaction, drama.

Maths:
Ma2: Number Solving numerical problems; 4a: choose, use and combine any of the four number operations to solve word problems involving numbers in 'real life', money or measures of length, mass, capacity or time, then perimeter and area; Ma4: handling Data; 2a: solve problems involving data; 2b: interpret tables, lists and charts used in everyday life.

Geography:
1a: ask geographical questions
2c: use atlases, globes, maps and plans at a range of scales; 2d: to use secondary sources of information, including aerial photographs. 2g: decision-making skills.
4b: recognise some physical and human processes and explain how these can cause changes in place and environments.
5a: recognise how people can improve the environment or damage it and how decisions about places and environments affect the future quality of people's lives.
5b: recognise how and why people may seek to manage environments sustainably, and to identify opportunities for their own involvement.

Citizenship:
1a: talk and write about their opinions, and explain their views, on issues that affect themselves and society.
2a: to research, discuss and debate topical issues, problems and events.
2j: that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment.
4: Developing good relationships and respecting the differences between people.

Resources needed:

- A selection of fruits from supermarket: include a variety of origin countries, including the UK, plus packed and non-packaged examples (note the origin of non-packaged items when buying them e.g. via photographing display with supermarket's permission).
- Large world map with some blank labels Copies of the Global Distances information sheet.
- Enough copies of 'Fruit Trumps' card templates for each child to complete one sheet of 6 cards.

Key Vocabulary:

Environmental impact, packaging, recyclable, non-recyclable, transport, food miles, organic, seasonal

What to do:

Introduction: Look at the different fruits & find where they came from on the world map - add labels to the map to build up an overall picture. Introduce the idea of food miles.

Class discussion - Transport: Consider how the fruits might have travelled to us - does it state this on the packaging? If not can you work it out by looking at the possible routes they have taken on the world map? What are the environmental impacts of this transportation? Do some modes of transport have more impact than others?

Class discussion - Packaging: Do any of the fruits have packaging? What is the purpose of this packaging? What environmental impacts might any packing have?

Individual exercise - Making 'Fruit Trumps' cards: Children choose a piece of fruit and use it to complete the categories of their top trump card. For the 'distance travelled' box they use the supplied table of distances in Km, or if it is from the UK, a route-planner website (e.g. www.theaa.com). Children should be able to glean the other information required for their cards from the fruit's packaging, or from information gained at the supermarket itself. They may need to make an educated guess at how their fruit has travelled to the UK by thinking back to the discussions earlier in the lesson. Repeat with other fruits until all 6 cards have been filled in.

Preparing to play 'Fruit Trumps': As a class look at the top trumps cards and discuss whether a high or a low score for each category would be a high or low environmental impact. During the game a fruit with a low environmental impact will always 'trump' one with a high environmental impact (for this game the lower the score the lower the environmental impact).

Group work - Playing 'Fruit Trumps': Divide class into smaller groups (6 to 8 children) and ask them to pool their cards to form a pack. Each group's pack is then shuffled and dealt between two smaller groups who will play against each other. Groups take turns to choose a category from their top most card and read out their score: The best value (lowest environmental impact) wins or 'trumps' the other team and wins their card. The winning team then places this card at the bottom of their pack along with the card they have just played and chooses a category for the next round from their new top-most card. The winners are the first group to gain possession of all of the cards, or the group that has the most cards after a certain time period.

Plenary: Which fruits have the lowest environmental impact? Why might the same fruits have scored differently on cards made by different people? How can we shop wisely to reduce our impact on the environment?

Extension activities and follow up suggestions:

- **Class discussion - Seasonality:** Are these fruits available all year or only during certain seasons? If they are available year-round, how is this achieved and what is the environmental impact of this?
- Set a challenge to find the ingredients for a meal with the smallest environmental impact.

Fruit Trumps

Scoring :

Use the lists below to work out the 5 scores for each of your 'Fruit Trumps' cards

Distance travelled :

Home-grown = 0 points
0-350km = 10 points
350-1000km = 20points
1000-5000km= 30 points
5000-10,000 km = 40 points

Mode of Transport:

Add up the points for all the transport methods used:
Ship = 8 points
Plane = 10 points
Train = 8 points
Lorry = 8 points
Car = 4 points
On foot/bicycle = 0 points

Packaging:

0 points if there is no packaging
5 points for each layer of recyclable packaging.
10 points for each layer of non-recyclable packaging

Organic:

0 is it is organic
5 points if it is non-organic

Type of Fruit:

Country of Origin:	
Distance travelled:	Points
Modes of Transport:	Points
Packaging:	Points
Organic:	Points
Total impact:	**Points**

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Country of Origin:	
Distance travelled:	Points
Modes of Transport:	Points
Packaging:	Points
Organic:	Points
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Type of Fruit:

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Distance travelled:	Points
Modes of Transport:	Points
Packaging:	Points
Organic:	Points
Total impact:	**Points**

Fruit Trumps—How far has my food travelled?

Continent - Europe

Country	Approximate distance
Cyprus	3218 km
France	343 km
Germany	929 km
Greece	2391 km
Ireland	469 km
Italy	1444 km
Russia	2508 km
Spain	1261 km
Turkey	2835 km

Continent - Australasia

Country	Approximate distance
Australia	16984 km
New Zealand	18331 km

Continent - Africa

Country	Approximate distance
Egypt	3520 km
Kenya	6804 km
Morocco	2011 km
South Africa	9027 km
Tanzania	7473 km
Tunisia	1821 km
Zambia	7906 km
Zimbabwe	8258 km

Continent - Asia

Country	Approximate distance
China	8262 km
India	6701 km
Japan	9676 km
Thailand	9534 km

Continent - North America

Country	Approximate distance
Canada	5376 km
Jamaica	7541 km
Mexico	8941 km
USA	5913 km

Continent - South America

Country	Approximate distance
Argentina	11082 km
Brazil	9186 km
Chile	11649 km
Costa Rica	8732 km
Ecuador	9215 km
Peru	10158 km
Venezuela	7503 km

Adapted from Soil Association 'Food For Life' Curriculum Pack

Pizza Processes - lesson plan

Following on from the fruit top trumps activity, this activity moves on to thinking about what is involved in producing processed foods and the environmental impacts of this.

Learning Outcomes:

- A broad understanding of the processes involved in producing processed food.
- An understanding of the range of resources consumed to supply us with food (e.g. fuel, energy, water, packaging materials) and the impact this can have on the environment.
- An appreciation of the importance of reducing the amount of food that is wasted.

National Curriculum Links:

Geography:

1a: ask geographical questions.

2c: use atlases, globes, maps and plans at a range of scales.

2g: decision-making skills.

5 a. recognise how people can improve the environment or damage it, and how decisions about places and environments affect the future quality of people's lives.

5b: recognise how and why people may seek to manage environments sustainably, and to identify opportunities for their own involvement.

Citizenship:

1a: talk and write about their opinions, and explain their views, on issues that affect themselves and society.

2a: to research, discuss and debate topical issues, problems and events.

2j: that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment.

4: Developing good relationships and respecting the differences between people.

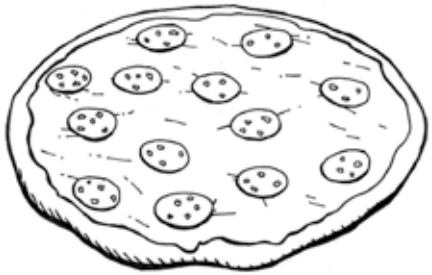
English: En1: Speaking, listening, group discussion and interaction.

ICT: 1: Finding things out: a. to talk about what information they need and how they can find and use it (for example, searching the internet or a CD-ROM, using printed material, asking people).

Key Vocabulary: Raw ingredients, processed food, food miles, environmental impacts, fertiliser, pesticide, herbicide, energy, transport, fuel, water, waste.

Resources needed: Shop-bought pizza (ideally pepperoni) or another processed food and its packaging.
Large pieces of paper and pens for brainstorming. Pizza Web and environmental impact cards – 1 set per group.

What to do:



Choose a processed food item e.g. shop-bought pizza.

- Introduce this **Fascinating Food Fact**: If you add together the distance travelled by all the ingredients in a supermarket pizza, it comes to **24,598 food miles**. That's once around the world! www.foodforlife.org.uk/Resources/Teachingresources/Resourceview/tabid/79/ArticleId/53/One-Planet-Food-Teachers-Activity-Pack.aspx
- Think back to the food miles and packaging work already done with fruit: we know that these have an impact on our environment, but **what other environmental impacts does a food have when it is a processed food rather than raw food like fruit?** Groups then try to list the processes that their food will have gone through to bring it from the farm to their plate.
- Groups then think about the resources needed for each of their processes e.g. water, energy (electricity or fuel), chemicals (fertilizers, pesticides, etc.), feeds, machinery, labour, materials etc. and any outputs e.g. waste materials in a variety of forms. Do these inputs and outputs affect the environment? If so how?
- As a class list all of the main raw ingredients for a pepperoni pizza (e.g. wheat, milk, tomatoes, pork).
- In their groups the children sort the Pizza Web cards into groups relating to each ingredient (e.g. Wheat – flour – dough). They then lay them out with the cooked pizza in the centre and the ingredients radiating out. They then use the environmental impact cards to label where in the process of making the pizza they think the impact may occur. They can write the type of impact in the box (e.g. transport, water, energy etc).
- **Plenary discussion:** Which ingredient of the pizza do they think has the greatest environmental impact and why? How could supermarkets reduce the environmental impact of a pizza? Are there any parts of the process that could be made more environmentally friendly? If we make our own pizza is there less environmental impact? Why is it important to eat all of the pizza once we've cooked it?

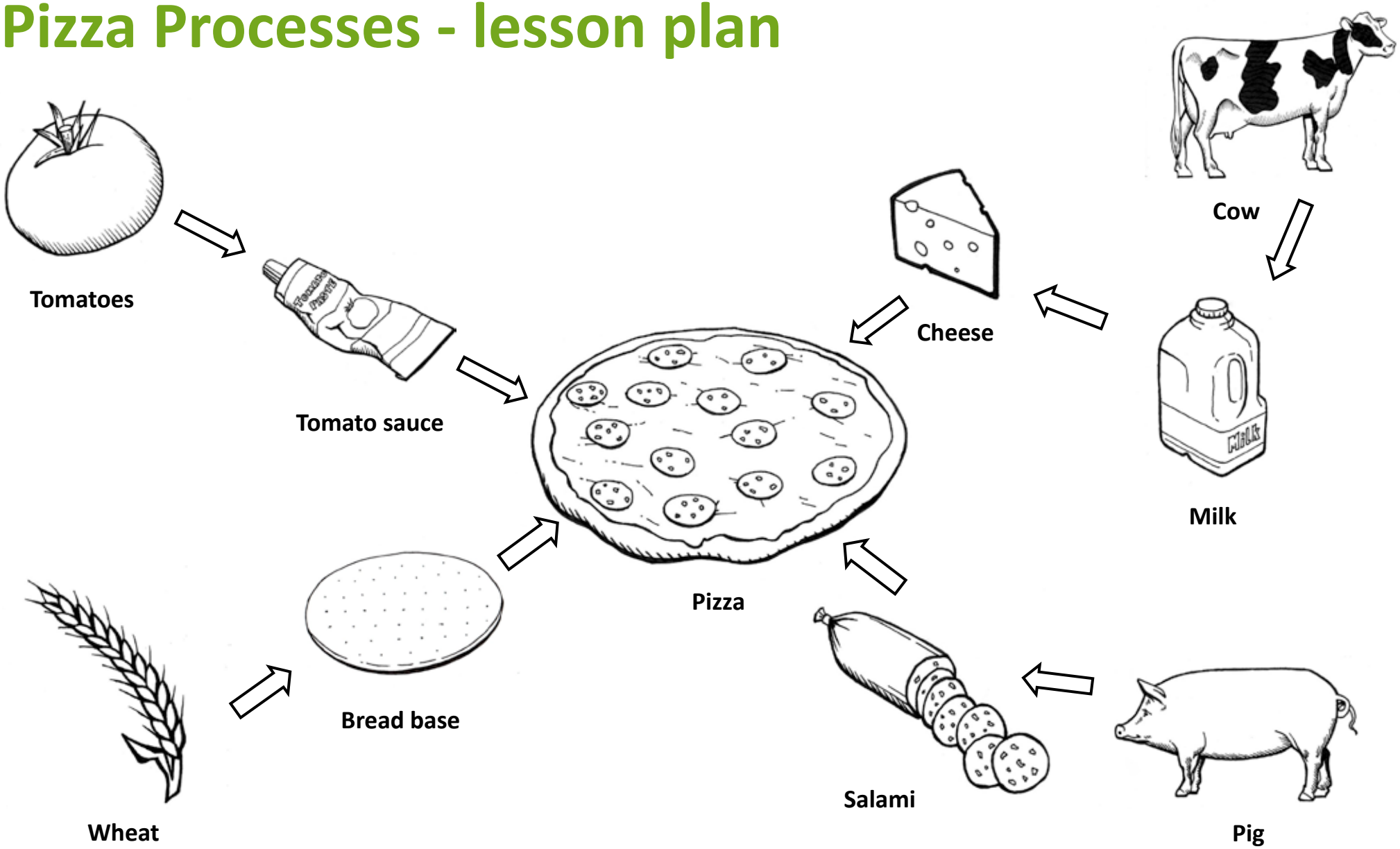
Extension activities:

Children could investigate the environmental impacts of other processed foods. Do some foods have a greater environmental impact than others? How could they change their shopping habits to reduce the impact, for example by sourcing local and seasonal produce?

Fascinating Food Facts!

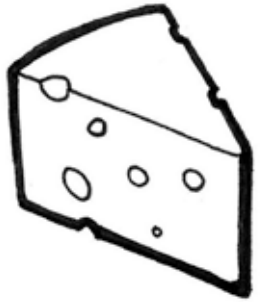
It takes 1,216 litres of water to produce a single 720g supermarket pizza.
(source: Waterfootprint.org)

Pizza Processes - lesson plan



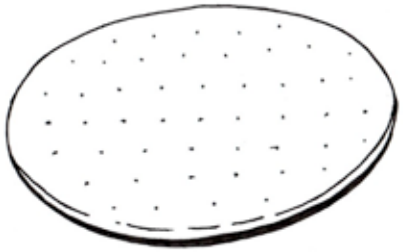
Tomatoes

Tomato sauce

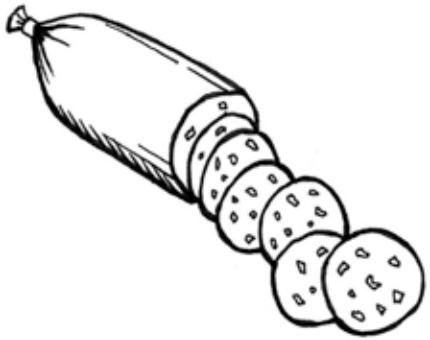


Cheese

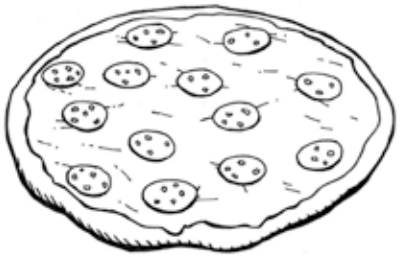
Milk



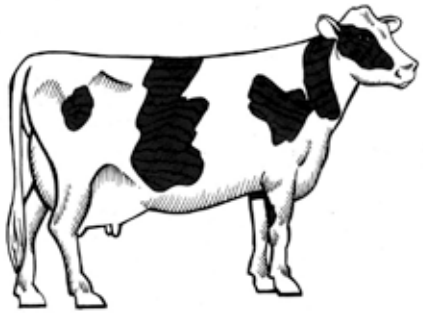
Bread base



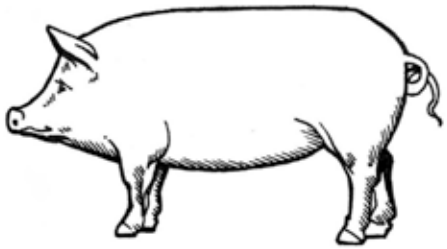
Salami



Pepperoni Pizza



Cow

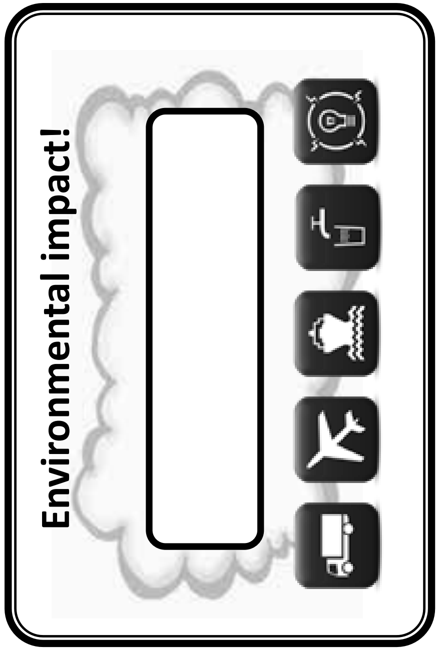


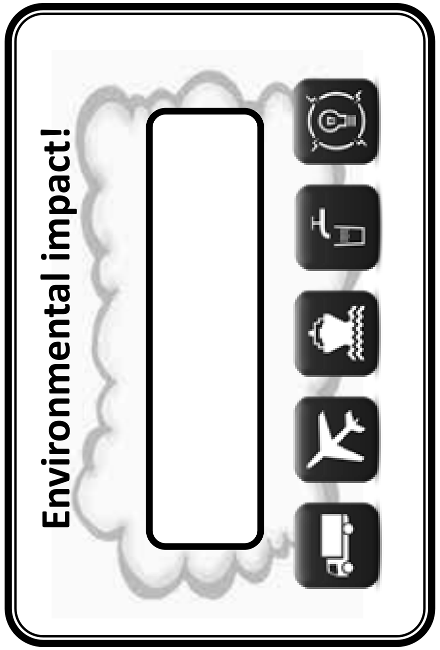
Pig

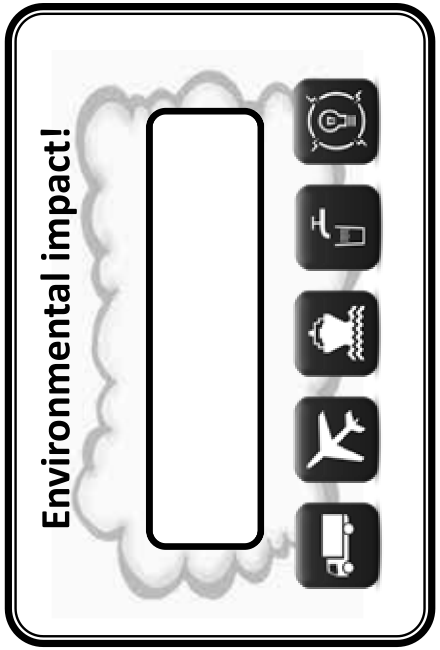
Wheat

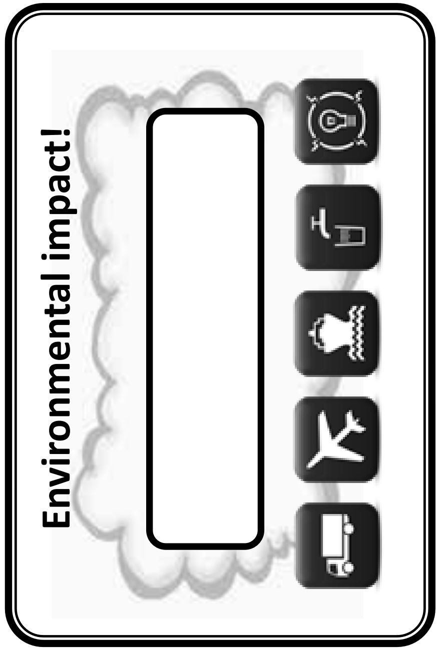
Pizza Processes—Food web cards

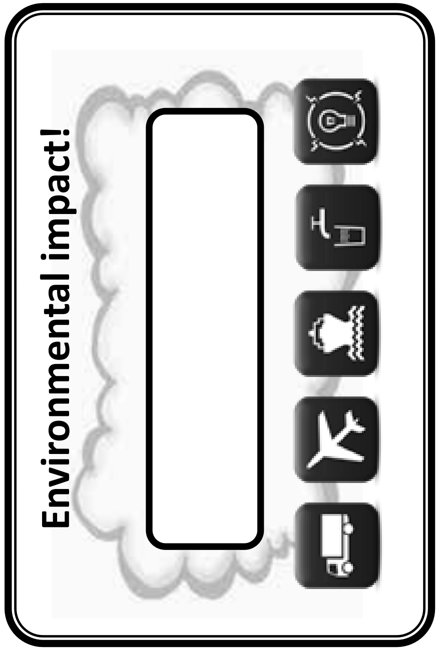
Pizza Processes—Environmental Impact cards

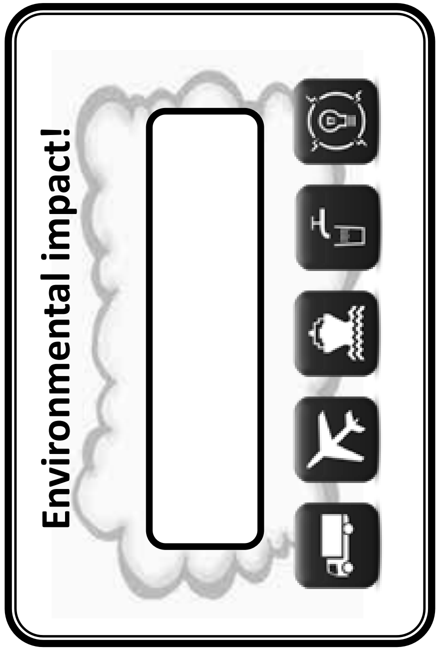


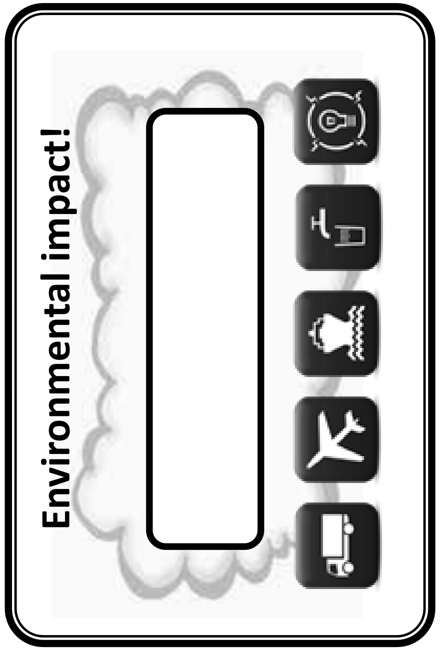


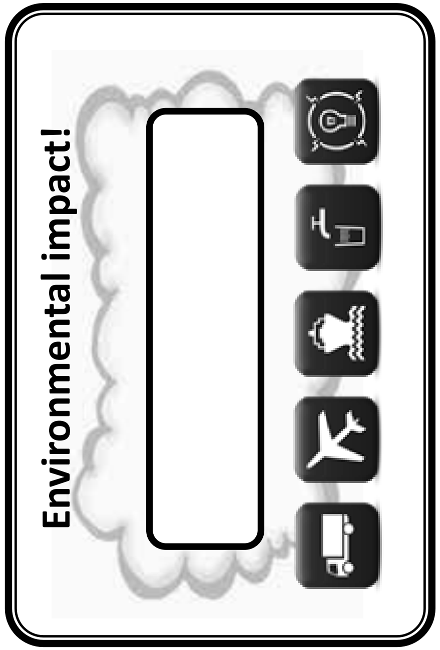




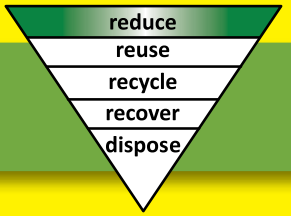








FOOD WASTE IN SCHOOL



Food is estimated to account for almost **half of the waste** produced by primary schools in England each year. This includes unavoidable waste which is inedible e.g. fruit skins, egg shells, bones etc as well as avoidable waste (edible food). For schools in England this avoidable waste totals **63,099 tonnes** per year- that's almost 80% of the total food wasted!

The total carbon emissions associated with this avoidable food waste is equivalent to 80,000 cars! (this covers the emissions accrued through food production and agriculture, processing, transportation, storage and disposal - a staggering 253,000 tonnes per year!)

Fascinating Food Facts

An estimated 80,382 tonnes food waste are produced by schools in England per (40 week) school year.

(source: School Food Waste WRAP 2010

What can you do to reduce food waste in school?

The first thing to do is work out how big a problem food waste is at your school and what types of food are contributing most to this. A **lunchtime waste audit** (you can use the recording sheet in appendix 3) is a good way to do this and gets everyone involved right from the beginning! You might choose to audit on several occasions to get an average picture. You could also **survey children** from each year group to find out why they wasted food and their overall experience during lunchtimes.

You can then use the findings of your audit to try to work out why food is being wasted and set targets for action to reduce this. Consider whether most food waste is coming from packed lunches brought from home or catered lunches, if food is wasted due to portion size, children's' dining experience, taste preferences or for other reasons? WRAP have developed a number of useful information sheets and case studies to help schools tackle lunchtime food-waste: **www.recyclenow.com/schools/reduce**

Why is good food wasted?

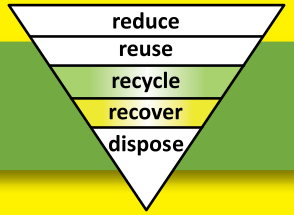
There are **two main reasons** why good food is thrown away:

- we cook or prepare too much
- we don't use it before it becomes in -edible or goes 'off'. (Source: Love Food Hate Waste)

Food waste created at school is often due to the first reason: too much food on our plates or in our lunch boxes for the size of our appetites!

Links: This link from the Norfolk Schools website provides details of how to run a 3-4 week audit in school:
www.schools.norfolk.gov.uk/Teaching-and-learning/Environmental-and-outdoor-learning/Schoolwaste/Schoolfoodwaste/NCC113225

WHAT CAN WE DO WITH FOOD WASTE?



The best option, to make the biggest savings, is to avoid creating food waste in the first place. But not all can be reduced and some types of food waste are unavoidable, such as tea bags, apple cores and potato peelings. What are the different options we have for disposing of food waste and which makes the most sense for the environment? On this sheet we're going to take a look at the options and some of the pros and cons of each.

Anaerobic Digestion

Food waste that goes into the brown food bins which are collected at the kerbside now goes to a new anaerobic digestion plant. This is a process where micro-organisms break down organic waste. The food waste is kept enclosed throughout the process to control the potential for animal diseases being spread through compost.

Pros

- As the waste rots down it produces bio-gas which can be burnt to generate electricity.
- The energy produced off sets the fuel used to collect the waste many, many times over.
- It can take all types of food waste.
- In addition to gas it also produces a compost for farmers to use. Recycling food waste saves £25 per tonne compared to sending it to landfill. Avoiding creating waste in first place would save over £90 per tonne (landfill disposal costs)!

Cons

- It's expensive to set up a facility.

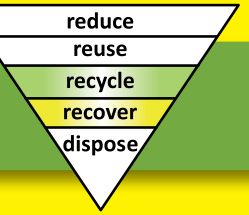
Gas works!

As far back as the 17th century people have been interested in making flammable gas from rotting organic matter although the first anaerobic digester wasn't built until 1859 (in a leper colony in Bombay in India).
Although the technology has vastly improved the principles have remained the same whether it's a small system for a house or a very large one like the new plant in Somerset.

Extension Activities:

Find out the energy potential of food! Why not try making electricity with a potato as this lesson plan from Miniscience demonstrates: **www.miniscience.com/projects/potatoelectricity**

ANAEROBIC DIGESTION-PLATE TO POWER!



1. Any type of food waste can go into your brown food bin – meat, bread, plate scrapings, small bones, you name it!

2. Once your food scraps have gone into the food waste bin they will be collected by the recycling lorry.

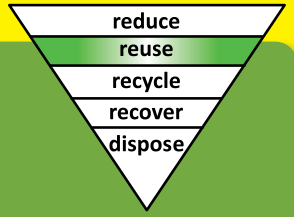
3. The lorry will then transport the food waste to the anaerobic digestion plant which will be able to process 30,000 tonnes of food waste each year.

4. As the waste rots down it will create gas, mostly methane, which will be burnt to generate electricity! In addition to the gas some compost is left which can be used as a fertiliser.

Image courtesy of Ventrilock/ FreeDigitalPhotos.net

AD plant Fact file:

- It cost about £10 million to build.
- It took around 1 year and 6 months to build.
- It will process up to 30,000 tonnes a year (20,000 tonnes of food waste will come from Somerset homes and the rest from local businesses like restaurants, catering firms, pubs and shops). In future the plant may be expanded to process an extra 15,000 tonnes of food waste per year.
- It will save £200,000 a year compared to Somerset's current food waste composting scheme.
- It has an electricity generating capacity of 1MW.
- It will generate around 9,500MWh of electricity per year: enough to power the needs of around 1,700 homes (or a town the size of Somerton) as well as the plant itself!
- The plant uses around 1,900 MWh (a 1/5 of the power generated) to power the plant, leaving around 7600MWh to be exported to the national grid.
- In the future it may be possible to clean the biogas produced by the plant so that it can either go directly into the national gas grid to be used by homes in Somerset, or be used as a fuel to power Somerset's refuse and recycling lorries! (This has even greater benefits in energy and environmental terms than generating electricity and so would make the process even more sustainable.)
- Recycling food waste saves £25 per tonne compared to sending it to landfill (however avoiding creating waste in first place would save over £90 per tonne (landfill disposal costs)!



Home Composting

Another option for food waste is to compost at home using a compost bin. Compost bins are a different type of composting as air is used in the process. In addition to veg peelings, fruit waste, old tea bags and the like, garden waste can also be composted. It is important to have a **good mix** of 'green' wet materials like fruit waste and grass cuttings and 'brown' materials like cardboard, sawdust, scrunched up paper and autumn leaves. You want a 50/50 mix of these 'green' and 'brown' materials. The 'browns' will help to soak up some of the moisture and help air to move around the compost bin. This is called **aerobic composting**. As the waste rots down it turn into compost which can be used on your garden to improve the soil and help plants grow.

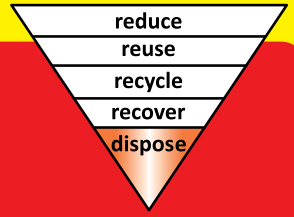
Pros

- The waste doesn't have to be transported anywhere and you get a lovely compost you can use, made from your own recycled waste!
- It **saves money** and means you don't have to buy compost.
- It's satisfying and has great education potential!

Cons

- It's best to avoid composting meat and cooked food waste though as this can attract rats!
- Not everyone needs or can make compost. Only 40% of households generally compost and for those people living in flats and without gardens it's not really an option.

For some tips and advice on composting in school please see **appendix 1.**



Landfill

The final option for dealing with food waste is to send it to landfill. This is the worst option and therefore comes at the bottom of the waste hierarchy.

Pros

- Landfill is a relatively easy process of tipping waste into a hole although the sites have to be built to a very high standard and monitored to ensure nothing escapes.
- The waste is disposed of relatively locally and doesn't have to travel too far.

Cons

- There is little air in a landfill site and any food waste will rot down in anaerobic conditions. This produces methane gas which is a greenhouse gas. Although some of this can be captured and burnt for energy a lot of this will escape into the atmosphere.
- It's expensive! Each tonne of waste that goes to landfill costs £72 in landfill tax (2013-14)
- We're running out of space! Our existing landfills are filling up, although this process has slowed down dramatically since recycling has increased, and it's very hard to find new sites. No-one wants to live next door to a landfill site!
- Landfill wastes resources—once waste is landfilled we lose all of its potential as a resource, whether that's as a source of energy or as something that can be recycled or reused.
- Landfill sites can be smelly and noisy places. It also means taking away habitats for wildlife although many landfill operators now seek to manage completed landfills to bring back wildlife. This happens at the Dimmer site where Carymoor has been working to create a range of new habitats to bring life back to the landfill site.

What does an anaerobic digester do? - lesson plan

This activity aims to explain how the anaerobic process works, what goes in and what comes out. It uses the digestion process of a cow as a comparison to reinforce that, although the AD plant is a very large industrial building, the breakdown of the food is brought about by natural processes.

Learning Outcomes:

A broad understanding of the processes involved in the breakdown of waste food in an anaerobic digester.

An appreciation of the environmental benefits of dealing with food waste in this way, including the production of electricity and soil conditioner.

National Curriculum Links:

Science:

SC2 Life Processes and Living Things:

1a that the life processes common to humans and other animals include nutrition.
1 c to make links between life processes in familiar animals and plants and the environments in which they are found.
5f that micro-organisms are living organisms that are often too small to be seen, and that they may be beneficial [for example, in the breakdown of waste] or harmful.

Geography:

2d to use secondary sources of information, including aerial photographs.

2g: decision-making skills.

4 b recognise some physical and human processes and explain how these can cause changes in place and environments.
5 a recognise how people can improve the environment or damage it and how decisions about places and environments affect the future quality of people's lives.
5 b recognise how and why people may seek to manage environments sustainably, and to identify opportunities for their own involvement.

Key Vocabulary:

Landfill, aerobic, oxygen, anaerobic, digestion, digestate, fertiliser, methane, climate change.

Resources needed:

Images of the anaerobic digestion plant from the introductory PowerPoint presentation.

A computer with an internet connection and ideally connected to a digital projector.

Copies of the anaerobic digester and cow sequencing cards – 1 set per group.

Accompanying Teacher's notes.

What to do:

Fascinating Food Facts!

In the UK we throw away **7.2 million tonnes** of food and drink from our homes every year! Around **5.3 million** tonnes of this is food that could have been eaten!

(source: Love Food Hate Waste website)

The previous lessons (Fruit Trumps & Pizza Processes) established that making some food waste can't be avoided and that sometimes composting isn't possible (either because of the nature of the food waste or lack of suitable outdoor space).

- Ask the children what would happen to this food waste if they were to put it in bin with non-recyclable rubbish? Show them the picture of the landfill site.
  Ask the children how many of them collect food waste in their brown caddy for the weekly kerbside collection? www.somersetwaste.gov.uk/collections/food/
- Explain that their food waste is taken to the anaerobic digestion plant in Somerset, where it is used to make electricity and to make a compost for farmers.
- Show the children the picture of the anaerobic digester (AD) plant. Explain that the word anaerobic means without oxygen from air and refers to the bacteria that will live inside the plant and feed off their food waste in a chamber without air in it. This is the opposite of aerobic which means with air, for example humans which need air in order to breathe in the oxygen that we need to keep ourselves alive.
  An AD plant like the one in the photograph is currently being built in Somerset to take their food waste. It will produce fertiliser from their food and will also make biogas (methane) which will be used to generate electricity. Use the link below to show the class photographs of the AD being built www.somersetwaste.gov.uk/about/ad/construction/
- Explain that the AD plant works a bit like the digestive system of a cow! Then give each group the 6 cards describing how a cow breaks down its food and ask them to see if they can arrange them in the right order.
- Once the groups have got the correct sequence for the cow's digestion they can then be given the 6 cards for the AD process which they need to match up with the corresponding cow card.
  As a class discuss the similarities and the differences between the 2 processes. Why is it better to send their food waste to the AD plant than to send it to landfill? Why is it better to use the biogas to generate electricity than to release it into the atmosphere?

Extension Activities:

The Horrible Science 'Burping Bacteria' sheet has several activities that could be used as a follow-on to this lesson.

Use scrap materials to build a model of an anaerobic digestion plant. This could then be used in the follow-on role play exercise.

Arrange a class outing to Carymoor Environmental Centre for a tour of the operational landfill site to see what happens to food waste if it isn't collected for recycling: www.carymoor.org.uk/education/actiondays.html

The use of methane to generate electricity could be extended to discuss climate change and also used to introduce further examples of renewable energy.

AD plant / Cow comparison—teacher's notes

Anaerobic Digestion Plant	Cow
Food waste is shredded into smaller pieces and mixed with water to give a soup-like consistency.	Food (e.g. grass) is chewed to break it into smaller pieces and mix it with saliva before swallowing (ingesting). Some swallowed food is regurgitated so that it can be chewed even more. This is called chewing the cud.
Food waste is next pumped into a sealed tank called a digester.	Food is swallowed and passes down a tube called an oesophagus, into the rumen which is the first chamber of a cow's stomach.
Conditions inside the digester are kept constant to allow anaerobic bacteria to survive: there is no oxygen and the temperature is kept at between 39 and 42 ^{o}C.	Conditions inside the rumen allow anaerobic bacteria to survive: there is no oxygen and the temperature is between 37- 40 ^{o}C.
Bacteria inside the digester feed on the food waste, breaking it down into smaller and smaller particles and taking in the nutrients they need to live and multiply.	Bacteria inside the rumen feed on the grass breaking down fibres and taking in the nutrients that they need to live and grow. This also makes the nutrients available to the cow.
Inside the digester the food waste is stirred constantly. This mixing action helps give the bacteria a constant supply of food to digest.	Muscles in the cow's digestive system contract constantly, mixing the contents of the rumen and giving the bacteria a constant supply of food.
As the bacteria in the digester feed on the food waste they produce methane and carbon dioxide. These gases collect at the top of the digester and are pumped into a special storage tank.	As the bacteria feed on the food they produce methane and carbon dioxide. These gases are released from the rumen and the cow's body when the cow burps!
Methane gas produced by the bacteria (bio gas) is cleaned and pumped to a combined heat and power turbine plant. At this plant the gas is burned and the heat produced is used to power turbines which in turn power a generator to generate electricity.	Cows produce methane and carbon dioxide gases that are released into our atmosphere. Most emissions come from belching, a smaller amount is released as farts. Methane is a powerful greenhouse gas, its effect on climate change is approximately 23 times stronger than carbon dioxide.
Undigested material and dead bacteria will be left at the bottom of the digester. This slurry is called digestate.	Food from the rumen (plus dead bacteria) passes into three more stomach chambers where it is digested further. It then passes through the cow's small intestine where the useful products of digestion e.g. amino acids from proteins, glucose from carbohydrates, fatty acids from fats, vitamins and minerals are absorbed into the cow's body. The remaining material travels into the large intestine where excess water is absorbed into the cow's body. Undigested food that has reached the large intestine is egested as the cow's body as dung!
It takes 12-14 days for food waste to be anaerobically digested.	It takes 1-3 days for food to pass through a cow's digestive system.
Digestate contains lots of nutrients and can be used by farmers as a soil conditioner to fertilise their fields.	Cow dung contains lots of nutrients and can be used by farmers to fertilise their fields. Also dried and used as a fuel in some parts of the world.

'What does an anaerobic digester do?'

Cow process cards

Cow

The cow chews its food to break it into small pieces. It mixes it with saliva to make it easy to swallow. Cows regurgitate their food so that they can chew it again to release more nutrients.

Cow

The cow swallows its food which passes down a tube into the first of its four stomach chambers called the rumen.

Cow

The cow's stomach contains bacteria that start to breakdown the food. They live without air in anaerobic conditions and work best at the cow's body temperatures. As these bacteria break down the cow's food they release the nutrients that they need to live.

Cow

Muscles in the cow's digestive system keep mixing the food and bacteria. They also push the mixture through the cow's other 3 stomachs and intestines.

Cow

As the bacteria in the cow feed on the food they produce methane and carbon dioxide. These gases are released from the cow's body when it burps! These gases are sometimes known as Greenhouse Gases as when they are released into the air they can contribute to climate change.

Cow

Undigested food leaves the cow's intestines as cow dung! Cow dung is rich in nutrients and can be used by farmers as fertiliser for their crops.

'What does an anaerobic digester do?'

AD process cards

Anaerobic Digester

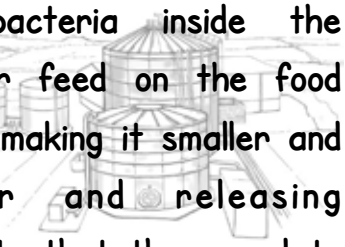
Food waste is shredded into smaller pieces and mixed with water to give a soup-like consistency.

Anaerobic Digester

Liquid food waste is pumped into a sealed tank called a digester.

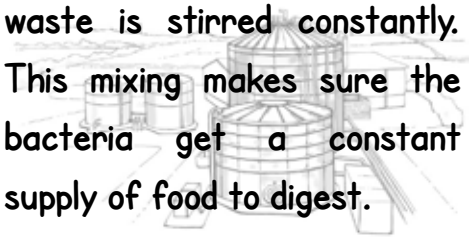
Anaerobic Digester

There are bacteria in the digester. They live where there is no air and at temperatures around 40°C. The bacteria inside the digester feed on the food waste, making it smaller and smaller and releasing nutrients that they need to live.



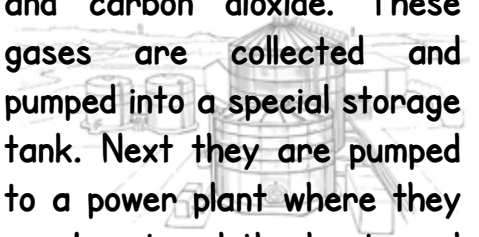
Anaerobic Digester

Inside the digester the food waste is stirred constantly. This mixing makes sure the bacteria get a constant supply of food to digest.



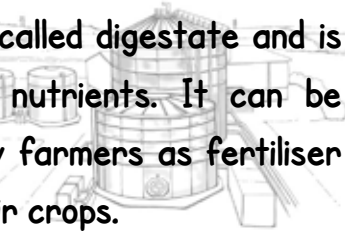
Anaerobic Digester

As the bacteria in the digester feed on the food waste they produce methane and carbon dioxide. These gases are collected and pumped into a special storage tank. Next they are pumped to a power plant where they are burnt and the heat used to drive a turbine that generates electricity.



Anaerobic Digester

Undigested material is left at the bottom of the digester. This is called digestate and is rich in nutrients. It can be used by farmers as fertiliser for their crops.



HORRIBLE SCIENCE™

written by Nick Arnold designed & illustrated by Tony De Saulles

BURPING BACTERIA

In Somerset waste food doesn't go to waste. It goes to an anaerobic digestion plant and bacteria turn it into gas for power...

Foul Food Challenge

Experts reckon that primary schools throw away 45 kg of waste per pupil per year. They say 46% of this is food. How many kg of food is this?

Can you work out how many kg of food your school chucks away?

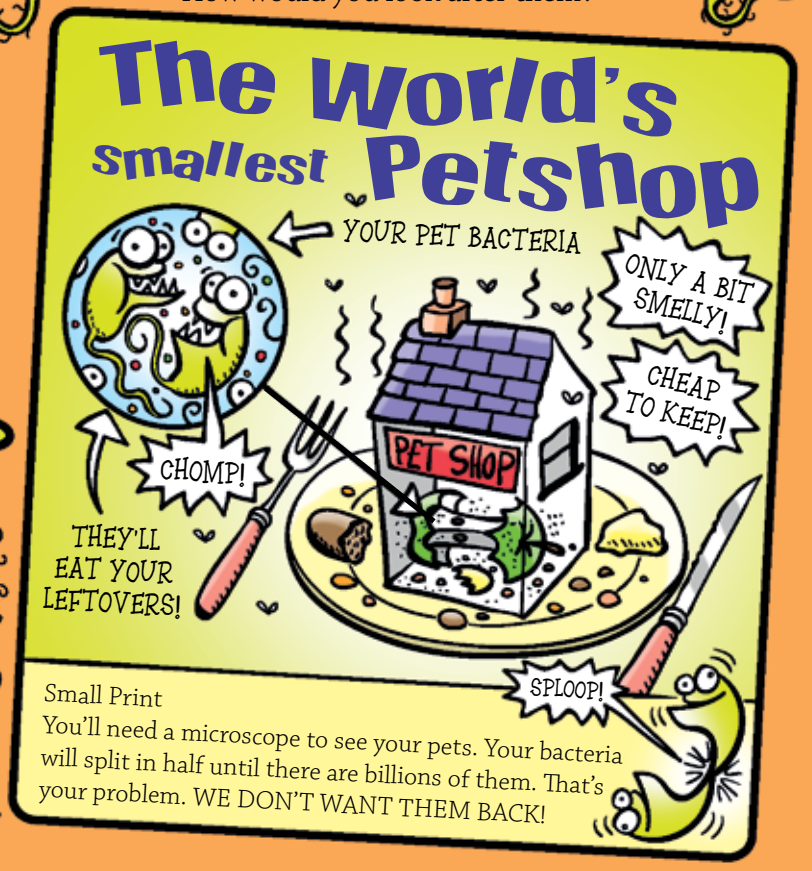
Foul Food Quiz

Here's a stinky rotting rubbish bag. Bacteria eat waste food. What foods can you spot? Which things aren't food?

Design a poster for your home showing things you can put into the brown bin.

Bacteria Pet Care

Imagine you had some pet bacteria. How would you look after them?



Write a pet-care manual on how to look after your bacteria.

These questions should get you started.

Where would you keep your pets? _____

What food do they need? _____

What drink do they need? _____

What is a good temperature for your pets? _____°C

Suggest three ways you can tell that they are alive? _____

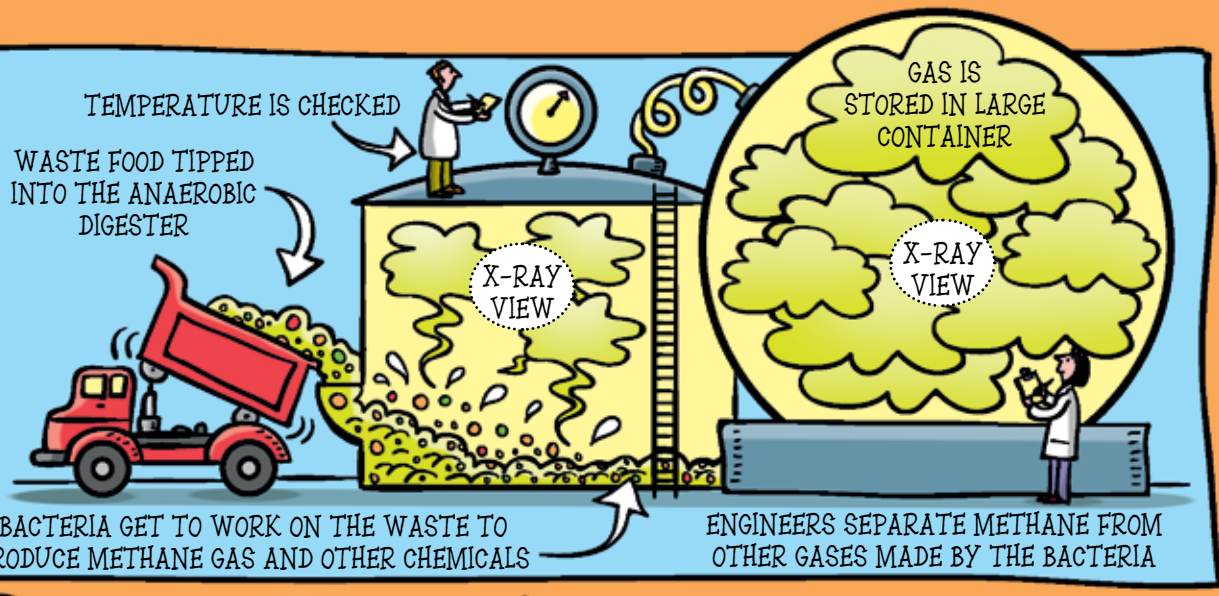
_____

Inside the Anaerobic Digestion Plant

Several types of bacteria guzzle the waste food. They grab energy from the food and mix its atoms into new substances.

Humans need air to get energy from food. (That's why we breathe!) The bacteria in the plant don't need air to do this. Scientists call them anaerobic bacteria.

Some types of bacteria make methane gas. Methane gas can generate electricity. It can be piped to homes for cooking and heating.



Dare You Discover - Anaerobic Microbes

1 Pour 225 ml of warm water into a jug.

2 Add 2 tablespoonfuls of sugar in the water.

3 Add 1 sachet of yeast powder and stir until the sugar and powder dissolves.

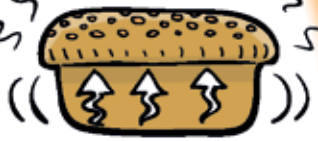
4 Quickly pour the mixture in the bottle and set up the experiment as shown.

You should find

The yeasts make bubbles. The gas slowly inflates the balloon. Yeasts aren't bacteria – they're a type of microscopic fungi. But they get energy the anaerobic way – without air. What would happen if the yeasts were too hot or cold?

Microbe Meal

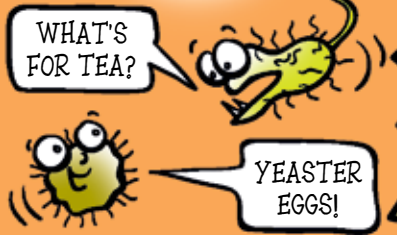
Did you know that gas from yeasts makes bread rise?



Design a revolting menu for a

BACTERIA BANQUET

of foods made by bacteria and other microbes.



Burping Bacteria Quiz TRUE or FALSE?

1 Some Victorian street lights used methane gas from sewers. Bacteria made the gas from rotting poo.

BLURP!

2 The Anaerobic Digestion Plant makes rude burping noises.

3 You could build a house from the remains of the waste food.

Freak out your friends with more horrible TRUE or FALSE? questions ...

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HORRIBLE SCIENCE™

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Teacher's Notes

This worksheet is designed to support teaching in:

- Science KS2
- SC1 Scientific enquiry – the DARE YOU DISCOVER Experiment.
- SC2 Life Processes and Living Things especially Life Processes (1a-c)
- Living Things in their Environment (5f) Micro-organisms

Foul Food Challenge

The figures are from *The Nature and Scale of Waste Produced by Schools in England (WRAP 2008)*. Other authorities argue for a higher figure. The research assumed a school year of forty weeks.

The Foul Food Challenge can be undertaken with or without calculators depending on the age and aptitude of the pupils. You may also challenge the pupils to relate the total weight of wasted food to easily understood quantities such as their own body weight or the weight of an elephant (about 5 tonnes).

Follow-up work could include observations of food waste at lunch-times and interviews with catering staff and children to establish why food is wasted.

Foul Food Quiz

This activity introduces the idea that bacteria "eat" food just like us. The poster also promotes home food recycling. You can point out that bacteria "eat" a wider range of "foods" than us. For example, they will "eat" the newspaper, which is why it is suitable for the brown bin.

Bacteria Pet Care

Remind the class of any comparative work they might have done about animal diets and habitats. Encourage the children to research the needs of bacteria. They should find that bacteria are living things and have the same basic needs as animals – food, warmth, moisture and somewhere to live.

The signs of life for bacteria are the same as any animal – movement, feeding and reproduction. Some children might suggest breathing, which although not correct provides an opportunity to talk about how gases enter and leave bacteria. Extension work could examine the harmful role bacteria play in spoiling food and causing disease.

Inside the Anaerobic Digestion Plant

The science of anaerobic digestion is quite complex. Begin by challenging the children to explain where their energy comes from. They should suggest food and this can lead to a discussion on how food and oxygen is needed to get energy.

Explain that the bacteria in the plant are like us in that they need to get energy from food – but unlike us they can do this job without air.

Ask the children to think of how food is transformed in the human gut and then explain that bacteria turn waste food into new substances. One of these is acetic acid, which the children have experienced in vinegar (8% acetic acid solution). Bringing some vinegar into the classroom might enliven this point.

Follow-up work could centre on the uses of methane gas and perhaps its role in global warming.

Dare You Discover

Depending on the age and aptitude of pupils, the experiment could be used as a small group task or class demonstration. The balloon should be prepared by inflating it a few times to make it saggy. Pupils with Spina bifida or latex intolerance should not undertake this task. Pupils should avoid inhaling the yeast. The pupils should draw before and after views of the experiment and write up what happened.

Microbe Meal

This activity allows the children to research beneficial microbes in the food industry. Encourage them to illustrate their menus with revolting cartoons!

Burping Bacteria Quiz

The quiz is meant to be a light-hearted coda to the project. It is likely to be popular and could develop into a class quiz. The answers to the quiz are:

1 TRUE – the gas was made in sewers. A few lights remain including a working replica next to the Savoy Hotel in London.

2 FALSE

3 TRUE – this is a chance to talk about digestate – the waste food residue. The solid variety can be made into fibreboard for building houses. It is normally used as a soil conditioner. The liquid variety is used as a fertiliser.

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Debate and role play - lesson plan

Time for your class to get into character! Children work in groups to debate a waste issue in your local community and put their persuasive writing, listening and speaking skills to the test.

Learning Outcomes:

- To investigate how real choices and decisions can impact upon peoples' lives.
- To use secondary information sources and personal experience to develop supporting arguments.
- To listen to the viewpoints of others.
- To engage in balanced and polite discussions

National Curriculum Links

Citizenship:

1a: talk and write about their opinions, and explain their views, on issues that affect themselves and society.

2a: to research, discuss and debate topical issues, problems and events.

2j: that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment.

4: Developing good relationships and respecting the differences between people.

Geography:

1d: Identify and explain different views that people, including themselves, hold about topical geographical issues.

2d: to use secondary sources of information, including aerial photographs; 2g: decision-making skills.

3e: to identify how and why places change and how they may change in the future. Knowledge and understanding of environmental change and sustainable development; 4b: recognise some physical and human processes and explain how these can cause changes in place and environments.

5a: Recognise how people can improve the environment or damage it and how decisions about places and environments affect the future quality of people's lives;

5b: Recognise how and why people may seek to manage environments sustainably, and to identify opportunities for their own involvement.

6e: an environmental issue caused by change in an environment and attempts to manage the environment sustainably.

English:

En1 speaking, listening, group discussion and interaction.

Key Vocabulary: Anaerobic digestion, reduce, re-use, recycle, landfill, rubbish, waste, environment, employee

Resources needed: Interactive whiteboard and projector. Pens/pencils. Topic cards on landfill, composting, anaerobic digestion. Briefing cards for each group. Class teacher to take the role of County Council Director (final decision-maker).

What to do:

Introduction (20 mins): Set the scene by explaining that new ways have to be found to deal with food waste that is coming from households in Somerset. A new Anaerobic Digester (AD) plant is proposed to be built on the outskirts of their town village near an existing landfill site. You could print off a map of your town / village from Google Earth or similar and mark a site on it for additional detail. Explain that the class will take on the roles of members of the local community and put forward arguments for and against the proposal at a town/village meeting. Highlight the importance of formulating a good argument and using persuasive language, as the aim of their discussions will be to persuade the Director of Somerset County Council (the class teacher and ultimate decision-maker), to agree with their group. Divide the class into 6 groups and provide each with the topic briefing cards on landfill, composting and anaerobic digestion ('What can we do with food waste?' sheets from pack) and a briefing card for their group. They can enter the name of their town / village in the space on their briefing card.

Debate (35 mins):

- Divide class into small groups and allocate each group the role of a different interest group from the local community. E.g. Local council, local home owners, local farmers, parish council, local environmental group, local wildlife group.
- Each group must decide whether they are in favour or against the proposal and formulate a valid argument in support of this view.
- Hold a town or village meeting where each group presents their argument 'in character'.
- Encourage discussion and an exchange of opinions about the various options and implications of the proposal.
- The class teacher will take on the role of decision-maker (Director of Somerset County Council): After listening to each group's presentation and class discussion they must decide if the proposal will go ahead, and give a reason for this.

Plenary (5 mins)

Did they find it easy to take on the role and opinions of someone else?

Discuss how they may have to take part in this type of discussion 'for real' during their lives: it is useful to be able to formulate and present a sound argument, listen to other people's viewpoints and discuss issues in order to come to a decision.

Extension Activities:

- Curriculum-linked activities and practical action on waste and recycling in school could be used as evidence towards an Eco Schools Award. For more information visit: www.keepbritaintidy.org/ecoschools
- Set-up an Eco-council or Green team in your school to give a voice to pupils concerned about environmental issues: www.keepbritaintidy.org/ecoschools/
- Practice your persuasive writing skills by writing to your local MP about a local, topical, environmental issue: www.parliament.uk/get-involved/contact-yourmp and www.theyworkforyou.com

The Role Play

The issue: **Somerset County Council has proposed to build a new Anaerobic Digester (AD) plant outside the town / village of**

_ _ _ _ _ _ _ _ _ _ _ _ next to an existing landfill site.

What you have to do: Your group has to put across the opinions of a particular set of people who will be affected by the new development at a village meeting.

Use the information provided to put together a good argument supporting your characters' views (even if they don't match your own).

A representative from Somerset County Council will be present at the village meeting to listen to all the points of view and will then decide what to recommend to the Planning Committee about whether the new plant should go ahead or not.

Should a new Anaerobic Digestion plant be built near

_ _ _ _ _ _ _ _ _ _ _ _ _ ?

Local Farmers

You **support** the idea of having an Anaerobic Digestion plant.

Think about the following when creating your supporting argument:

- What will the new AD plant produce that might benefit you?
- How might land that is used for farming be protected in the future if the AD plant is built?
- How could any new jobs created help you sell your produce locally?

Should a new Anaerobic Digestion plant be built near

_ _ _ _ _ _ _ _ _ _ _ _ _ ?

Local Home Owners

You **do not** like the idea of having an Anaerobic Digestion plant near your home.

- Think about the following when creating your supporting argument: How would the new AD plant affect traffic?
- How much waste will have to be transported to the site from across Somerset?
- Why is so much food waste produced in the first place? Could education help reduce this?
- Will the value of your house go up or down if it's close to a large waste facility?
- How much is the plant costing to build?

Should a new Anaerobic Digestion plant be built near

_ _ _ _ _ _ _ _ _ _ _ _ _ ?

Local Sustainability Action group

You **love** the idea of a new Anaerobic Digestion Plant.

Think about the following when creating your supporting argument:

- How does recycling food waste help the environment?
- What environmental benefits will the new plant provide?
- How could your group encourage people to recycle more of their food waste?
- As well as recycling food waste what else can people do to reduce the amount of waste sent to landfill sites?

Should a new Anaerobic Digestion plant be built near

_ _ _ _ _ _ _ _ _ _ _ _ _ _ ?

Members of the Local Council

You **support** the idea of building a new Anaerobic Digestion plant in this area.

Think about the following when creating your supporting argument:

- How could the new AD plant save the Local Council money? (Hint: How much does the council pay to send local residents' waste to landfill?)
- Will the AD plant create any jobs for local people?
- What will happen to food waste if it doesn't go to an AD plant?

Should a new Anaerobic Digestion plant be built near

_ _ _ _ _ _ _ _ _ _ _ _ _ _ ?

Parish Council

As a group you must **decide on your own opinion** but also ensure that your argument represents the overall view of all pupils at your school.

Think about the following when you create your supporting argument:

How would the new AD plant affect:

- Traffic?
- What benefits will the plant provide to your local area and across Somerset?
- What happens to residents' food waste?

Should a new Anaerobic Digestion plant be built near

_ _ _ _ _ _ _ _ _ _ _ _ _ _ ?

Local Wildlife Group

You **do not** like the idea of having an Anaerobic Digestion plant on land in your area.

Think about the following when creating your supporting argument:

- What wildlife (animals and plants) could be living in and around the proposed site of the AD plant?
- If the land is built on what will happen to this wildlife?
- How might wildlife be affected by any extra traffic using the local roads?

Plenary - lesson plan

This session is designed to pull together the different aspects of the food waste topic covered in the previous sessions. It gives pupils the opportunity to respond to the questions posed in the introductory PowerPoint presentation.

Learning Outcomes:

Pupils have sufficient understanding of the issues around food waste and environmental impact, its reduction and management to be able to communicate them to others confidently.

National Curriculum Links:

As well as reinforcing the curriculum content of the previous sessions this lesson also has the potential to cover the following:

English:

En1: Speaking, listening, group discussion and interaction, drama.

En3: Writing – composition, planning and drafting.

Citizenship:

1a - talk and write about their opinions, and explain their views, on issues that affect themselves and society.
2a - to research, discuss and debate topical issues, problems and events.
2j - that resources can be allocated in different ways and that these economic choices affect individuals, communities and the sustainability of the environment .

ICT

2a - how to develop and refine ideas by bringing together, organising and reorganising text, tables, images and sound as appropriate
3a - how to share and exchange information in a variety of forms [for example, displays, posters, animations, musical compositions]
3b - to be sensitive to the needs of the audience and think carefully about the content and quality when communicating information

Key Vocabulary:

This lesson re-visits vocabulary used in previous sessions.

Resources needed:

Introductory PowerPoint presentation,

Materials and resources to allow pupils to prepare and make their own presentations. These could make use of PowerPoint or be printed materials to be used as a class display.

What to do:

Use the introductory PowerPoint presentation as a starting point for this lesson.

- Revisit the questions that were posed at the start of their work on food waste and the Anaerobic Digestion plant. How would the pupils now answer these questions? Is there any other information that they need and, if so, where might they find it?
- The pupils now have the opportunity to present their answers to the boy in the presentation who set them the questions. This could be done in a number of ways:
  - They could write a letter explaining what he can do with his food waste now that he lives in Somerset.
  - They could use what they have learnt with information on the Somerset Waste Partnership website www.somersetwaste.gov.uk to prepare their own PowerPoint presentation.
  - The information could also be presented as a display, perhaps in a prominent place in the school such as their **Eco-Schools** notice board.

Extension Activities:

- Pupils could produce leaflets and posters to take home to encourage other family members to reduce their food waste and to collect any that is unavoidable in their brown caddy for kerbside collection.
- They could also write newspaper articles or even make a short video about the new Anaerobic Digestion plant at Walpole. For schools that don't have the facilities or experience of making videos the 'Lights, Camera, Green Action!' outreach workshop offered by the education team from Carymoor Environmental Trust may be of interest: www.carymoor.org.uk/education/lights_camera_green_action.pdf
- Once the AD is fully operational pupils can use the Somerset Waste Partnership website to follow it working: www.somersetwaste.gov.uk/about/ad/

Composting in School

Appendix 1

Making compost is a great way for children to experience recycling in action! As well as being good for the environment, a school compost bin is an excellent teaching resource, with links to topics such as:

Minibeasts
Habitats
Improving the environment
Helping plants grow
Food Chains
Micro-organisms

Getting started

Before you start composting there are a number of issues to consider carefully:

1. BINS
Compost bins come in a variety of styles, sizes and prices from the typical plastic 'Dalek' style bin through to sealed containers that can take cooked food waste. Somerset Waste Partnership offer a range of compost bins at reduced prices:
www.somersetwaste.gov.uk/more/composting/bin-offer/

Another option is to build your own wooden compost bin from old pallets. These will give more space for your compost and are a great way to reuse any old wood you have: **www.somersetwaste.gov.uk/more/composting/make-bin/**

2. LOCATION
Decide where to put your compost bins. A warm sunny site will result in faster composting. Ideally place your bins on soil or grass to allow minibeasts to get in. It's also good to site bins away from buildings but not so far away that they won't be used.

3. BALANCE
Composting will NOT work well if you fill your bin entirely with fruit waste. To avoid a slimy mess infested with fruit flies you need to add 'brown' materials each time you add your fruit waste. The ratio of green: brown material needs to be about 50:50.

GREENS (fast rotters)	BROWNS (slow rotters)
Tea bags	Shredded paper
Plants and flowers	Torn up cardboard
Fruit and vegetable peelings	Paper hand towels
Grass cutting	Wood shavings, Dead (brown) leaves, straw

4. COLLECTION ROTA
Work out who's going to collect the waste and empty it into the compost bin: You could appoint compost monitors from each class who take turns to look after and 'feed' the bin. Don't forget to decide who's going to add the 'browns'! It's also a good idea to have a designated adult to oversee the whole system. This could be a teacher, LSA or perhaps a keen parent.

Top Tips

Now you've got your compost bin up and running here are some top tips to look after it:

OXYGEN
The organisms that live in the compost bin need to breathe so give the contents of the compost bin an occasional turn to let more air in.

FLIES
If you get fruit flies, leave the lid off the compost bin for a few days to let the compost dry out and the flies fly away. Alternatively cover the compost with a piece of old carpet or bubble wrap until the flies go away.

KEEPING OUT VERMIN
To avoid any unwanted visitors coming to your compost bin **don't put any cooked food waste into the bin**. If you put some twigs and ready-made compost into the bin before adding any waste this should also prevent vermin getting in!

USING YOUR COMPOST
It will take your compost about a year to rot down, after which you will be able to use it. You can tell when it's ready when it looks brown and crumbly and you can no longer recognise the ingredients. You could use the compost for growing flowers or vegetables (Curriculum link: Science Sc2: 3 Green Plants).

BE REALISTIC!
It's much more important for pupils to have a positive experience of composting than to compost every piece of fruit every day.

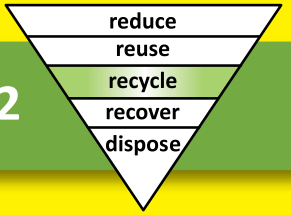
Carymoor Compost Workshops

Our education team can deliver a variety of compost workshops and assemblies in your school, including hands-on games, investigating compost minibeasts and seed planting. Infant classes can even be visited by our special friend Wigglebert worm! If you would like a particular class or your school green team to have ownership of composting at your school, we can help them set the scheme up, offer advice and teach them management and troubleshooting techniques.

For more information visit **www.carymoor.org.uk/education/ks_workshops.html** or contact us on **01963 351350** or email **education@carymoor.org.uk**

RECYCLING IN SCHOOL

Appendix 2



Schools Recycling Services

If you are a Local Education Authority (LEA) school or Academy, you can arrange waste and recycling services through Somerset County Council. Services can be tailored to suit your needs and budget: Schools can choose from a variety of wheelie bin options or refuse sacks for their weekly refuse collection service.

For recycling, SCC offer either kerbside boxes and food caddies emptied weekly, or wheelie bins emptied fortnightly. These collections are for paper, cans, glass and food waste (collections for cans and glass would only be set up if there is a sufficient quantity). Schools can also have a weekly cardboard recycling collection, either via a wheelie bin or small amounts can be flat-packed next to kerbside boxes. Work is underway to add additional materials to the recycling collections, including plastic bottles. For more information and advice contact Somerset County Council contract support team on **01823 355768.**

If you are not an LEA school you need to make your own arrangements for waste and recycling collections. There is lots of information and advice about setting up these collections on the Business Recycling pages of the Somerset Waste Partnership website **www.somersetwaste.gov.uk/business/**

Somerset Waste Partnership

Spreading the word!

If you are setting up a new school recycling scheme or re-invigorating a current scheme Carymoor Environmental Trust can deliver a variety of Workshops in your school to introduce pupils to waste issues and the 3 Rs (Reduce, Reuse and Recycle), or extend their knowledge. For more information visit our website: **www.carymoor.org.uk/education/ks_workshops.html**

Recycling for Charity

As a school you could also collect certain extra materials for reuse and recycling and raise money for charity at the same time. A variety of organisations are involved in collecting a wide range of waste items, from old clothes to mobile phones. Here are a few examples:

- Mobile phones and empty printer cartridges: www.recycle4charity.co.uk
- or www.reciproc8.co.uk/go/schoolclubs/associations-clubs
- Printer Cartridges: www.recycleaid.co.uk
- Used Stamps: usedstampsforcharity.weebly.com
- Textiles: www.bagitup.org.uk

Recycling at Home

Somerset Waste Partnership (SWP) provides 'Sort It Plus' collections for suitable households in all Somerset districts. The scheme involves weekly recycling and food waste collections, plus fortnightly collections for non-recyclables. Additional collections of garden waste can be made via a charged service arranged by each district council.

For detailed information about household waste and recycling collections in Somerset, visit the SWP website: **www.somersetwaste.gov.uk/collections/**

A full guide to recycling and waste services in Somerset can also be downloaded from the website.

Collections from blocks of flats and communal properties are slightly different: **www.somersetwaste.gov.uk/collections/communal/**

The SWP website has detailed information about what happens to the materials collected for recycling: **www.somersetwaste.gov.uk/collections/how/**

As well as information about where to take items that are not collected at kerbside: **www.somersetwaste.gov.uk/sites/**

General information, activity ideas and resources

Eco Schools - International awards scheme to guide schools on their sustainable journey - www.keepbritaintidy.org/ecoschools

The Pod - Games, videos, blogs, lesson plans and other resources, all designed to make your school greener - www.jointhepod.org

RecycleNow Schools - national recycling information - www.recyclenow.com/schools/index.html

Recycle More - one stop recycling information - www.recycle-more.co.uk

Recyclezone - education resources from Waste Watch - www.recyclezone.org.uk

Recycle Guide - general educational recycling guides - recycling-guide.org.uk

Circular Economy - free educational resources from the Ellen MacArthur Foundation - www.ellenmacarthurfoundation.org/news/free-downloadable-teaching-resources-for-uk-schools

Energy Saving Trust - for ways to save and generate energy and save money - www.energysavingtrust.org.uk

Go Green Week 2013 - environmental website aimed at students - peopleandplanet.org/gogreenweek

Educational resources linked to specific materials:

Alupro – aluminium recycling - www.alupro.org.uk/sectors/schools-education

British Glass Recycling – glass recycling - www.recyclingglass.co.uk British

Metals Recycling Association – metal recycling - www.recyclemetals.org/metals_and_me

Every Can Counts – can recycling - www.everycancounts.co.uk

LMB – textile recycling - www.lmb.co.uk/learn.html

Paperworks – paper recycling - www.paperworks.ebcnet.co.uk

Recoup – plastic bottle recycling - www.recoup.org/business/default.asp

Recycling Glass – British Glass recycling - www.recyclingglass.co.uk Steel

Can Info Recycling Bureau – steel can recycling - www.scrib.org.uk Think

Cans – can recycling - www.thinkcans.net

Lunchtime food waste audit—packed lunches

Appendix 3

Type of Food Waste	Weight (g)			Most common food item	% of total	Average weight (g)
	Audit 1	Audit 2	Audit 3			
Sandwiches				A1: A2: A3:		
Vegetables (e.g. salad, carrot sticks)				A1: A2: A3:		
Other savoury (e.g. crisps, pastry)				A1: A2: A3:		
Dessert (e.g. biscuits, yoghurt)				A1: A2: A3:		
Fruit				A1: A2: A3:		
Total Weight (g)						

Lunchtime food waste audit—catered meals

Appendix 3

Type of Food Waste	Weight (g)			Most common food item	% of total	Average weight (g)
	Audit 1	Audit 2	Audit 3			
Vegetables				A1: A2: A3:		
Meat or fish				A1: A2: A3:		
Other savoury (e.g. pasta, rice, pastry, cheese, egg)				A1: A2: A3:		
Dessert (e.g. cake, custard, yoghurt)				A1: A2: A3:		
Fruit				A1: A2: A3:		
Total Weight (g)						