

Name: .....

Grade: .....

School: .....

Date: .....

## WithOnePlanet

- > Module 1: Carbon
- > Level: Years 7 to 8
- > INQuIRY: Investigate
- > Lesson 4: Hitch a ride on the carbon cycle
- > Student worksheet



# Investigate

Lesson 4

Student worksheet

Hitch a ride on the carbon cycle

Years **7** to **8**



WithOnePlanet

Open education  
An xpend Foundation initiative

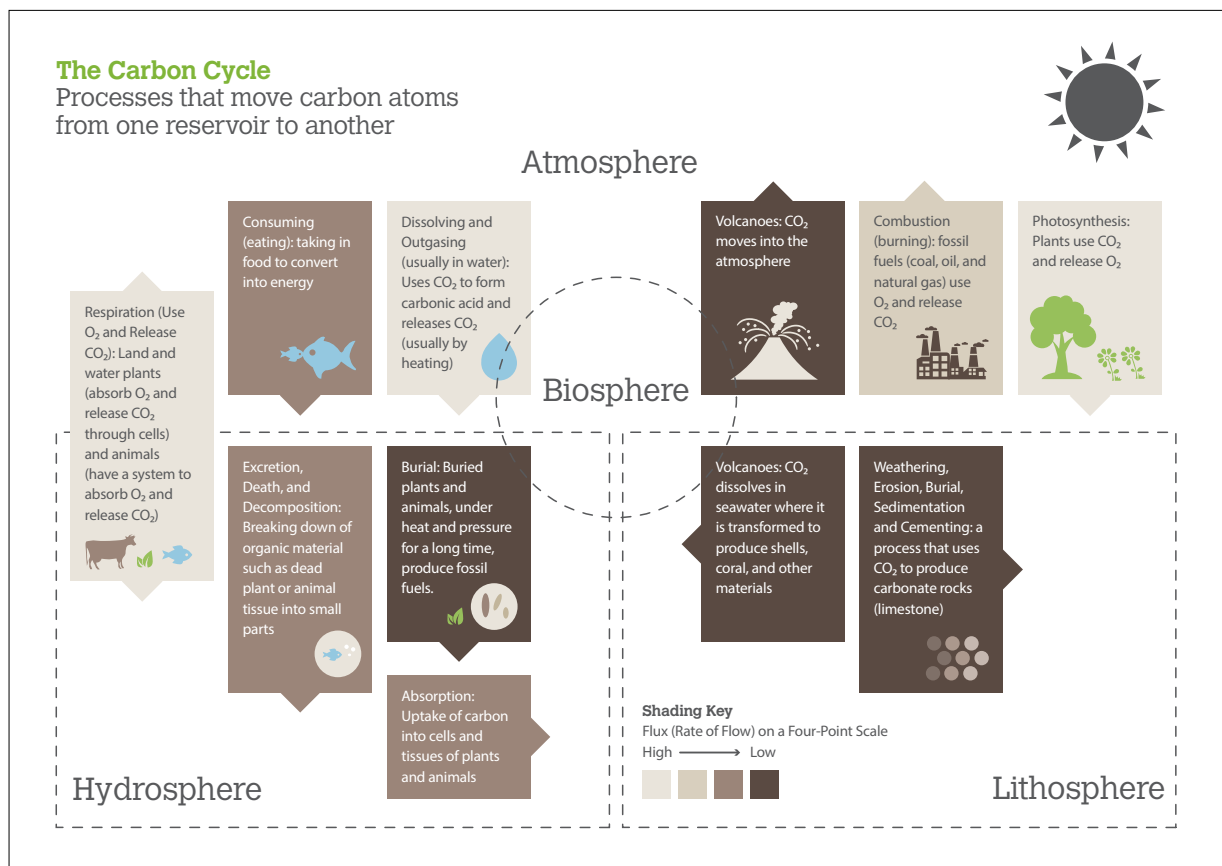
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INQuIRY     

# Hitch a ride on the carbon cycle

## Lesson 4: Student worksheet

Welcome to the carbon cycle!



At first glance, it can look quite overwhelming, so let's travel through the carbon cycle one step at a time to make more sense of it.

### 1. Carbon stores

A carbon store is anything that absorbs more carbon than it releases. Carbon stores are also referred to as **carbon sinks**. They can lock carbon away for indefinite periods of time, but that time can change depending on the type of store that's involved.

One example of a very long-term carbon store is a fossil fuel deposit (such as coal) in the lithosphere. *Can you find this on the diagram?*

Source:  
WithOnePlanet, the carbon cycle infographics 2015.

**Task 1**

- > Circle all the different carbon stores you can see on the diagram.
- > Make a list of these carbon stores and which sphere they are located in (hydrosphere, lithosphere, atmosphere or biosphere) in the table below.

Carbon stores in the carbon cycle	
Carbon store	Sphere it is located in
> Carbon store	> Sphere it is located in



**Flux (or flow rate)**

You will also notice that the diagram has a shading key in the bottom right hand corner. This shading key shows flux or rate of flow from a low rate to a high rate. You will notice that each process (indicated by a box and arrows) is shaded according to its flux or flow rate.

Flux, or flow rate is a measure of how quickly a process happens.

Some processes happen very slowly – i.e. over millions of years. An example of this is the rate of burial of dead animal and plant material over time that eventually forms fossil fuels.

In contrast, some processes happen very quickly – i.e. respiration. Both plants and animals do this millions of times on a daily basis.

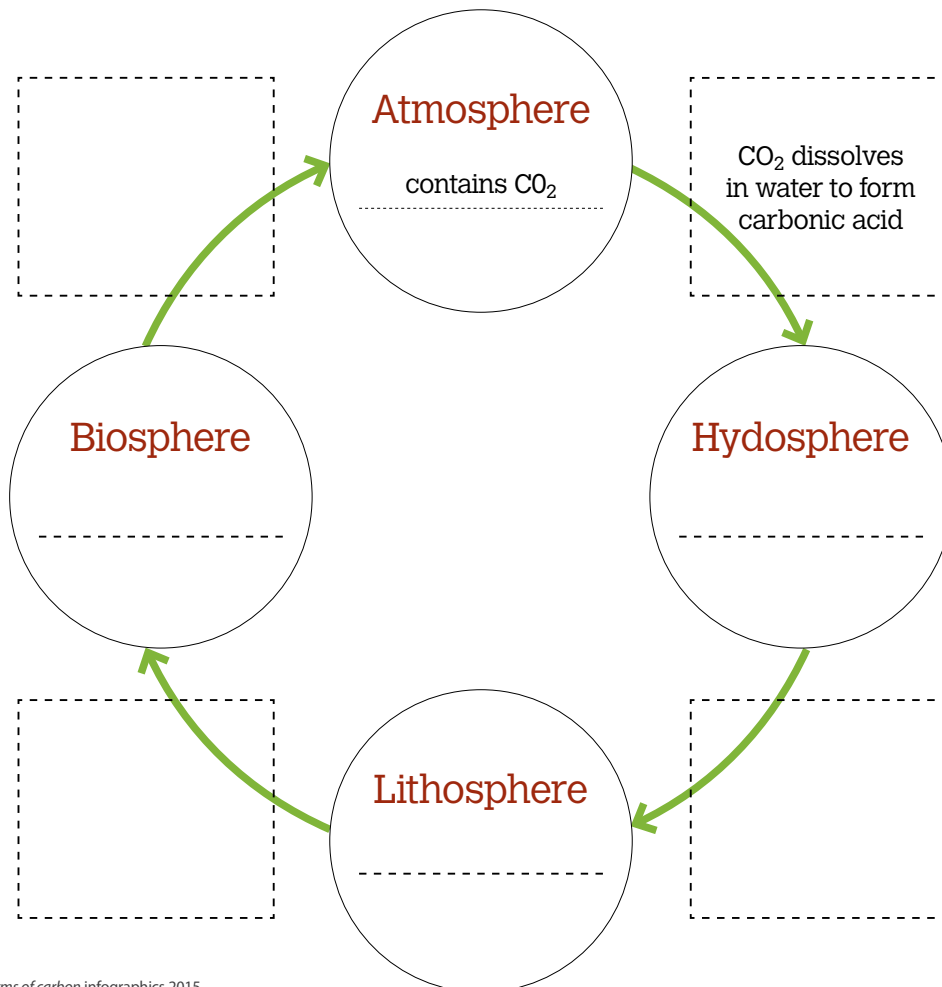
**3. Summarising the carbon cycle**

Another way to see everything that’s happening in the carbon cycle is to represent it as a flow chart that shows the forms carbon takes and the pathways that it uses to move around.

A flow chart template with an example has been provided for you below.

**Task 3**

- > Complete the flow chart by filling in the forms of carbon that are present in each sphere and connecting the spheres with labelled arrows that indicate the processes occurring to move carbon between each sphere.



Source:  
WithOnePlanet, forms of carbon infographics 2015.

## Energy transfers and transformations

### What is energy?

Energy enables us to do things. 'Doing things' is sometimes called work. So, energy is often defined as the ability to do work. Without energy nothing would do anything! The sun wouldn't shine, the birds wouldn't sing, we couldn't breathe ... nothing would actually exist. So thank goodness for energy!

### Forms of energy

Energy comes in a range of different forms. The following images give you a clue as to the different forms that energy can exist in. Try to work out what each form is and label each image below.

Energy is able to move between these different forms. This process is called energy transformation, or energy conversion.

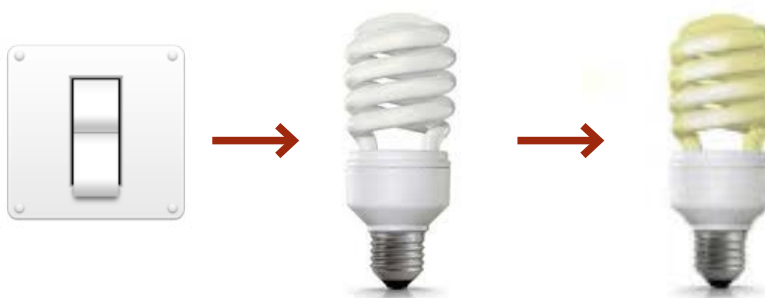
For example, when you eat a snack after school, you are eating chemical energy. After your body digests the snack, it can start converting or transforming the chemical energy into all the different forms of energy it needs to stay alive, such as kinetic energy (so that we can move), heat energy (so that we can stay warm), electrical energy (so our nerves can work) and so on. All of these are examples of energy transformations.

### Energy on the move

Energy can also move between different objects. In the example of your after-school snack, the energy is moving from your snack food into your body. This is known as an energy transfer. When you warm your hands in front of the heater, heat energy from the heat is transferring to your hands. When you ride your bike to school, energy from your body is transferring to your bicycle so that it can move. The examples are endless.

You may have already realised that when energy transfers from one object to another, it often transforms from one form into another at the same time. For instance, in the example in Figure 1 below, each blue arrow represents both an energy transfer and an energy transformation.

### Energy transfers and transformations when a light is switched on



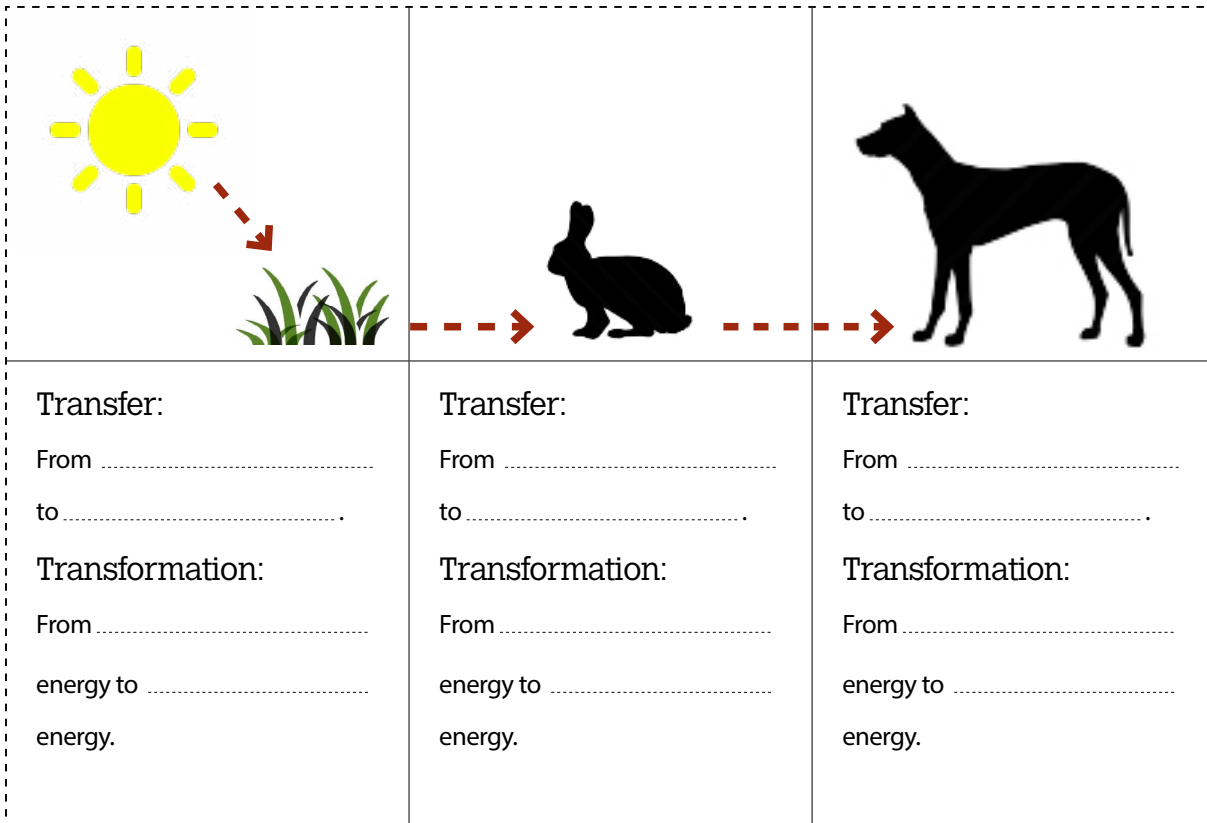
Source:  
WithOnePlanet, *energy transfer* infographics 2015.

Can you think of what these transfers and transformations might be? Have a look at the flow chart below of energy transfers and transformations for the example in Figure 1 below to see if you are correct.



**Q1:** Now have a go at completing your own flowchart by filling in the blanks in the example below.

(HINT: Not all the arrows have energy transformations.)



Source:  
WithOnePlanet, energy transfer infographics 2015.

## Energy transfer and transformation stations!

Set up around the room are 8 stations, each of which involves an energy transfer and an energy transformation. Follow the instructions at each station and complete the flow charts below.

*Note: For each station, you will need to draw a sketch of both objects involved.*

### Station 1

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

### Station 2

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

### Station 3

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

### Station 4

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.



**Station 5**

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

**Station 6**

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

**Station 7**

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

**Station 8**

Object 1 .....

Object 2 .....

Transfer:

From .....

to .....

Transformation:

From .....

energy to .....

energy.

## The most outrageous way to share a Coke



Watch the video *The Most Outrageous Way to Share a Coke*  
<http://youtu.be/Kc8TCivr10U>



In the table below, list as many energy transfers and transformations that you saw on the video as you can.

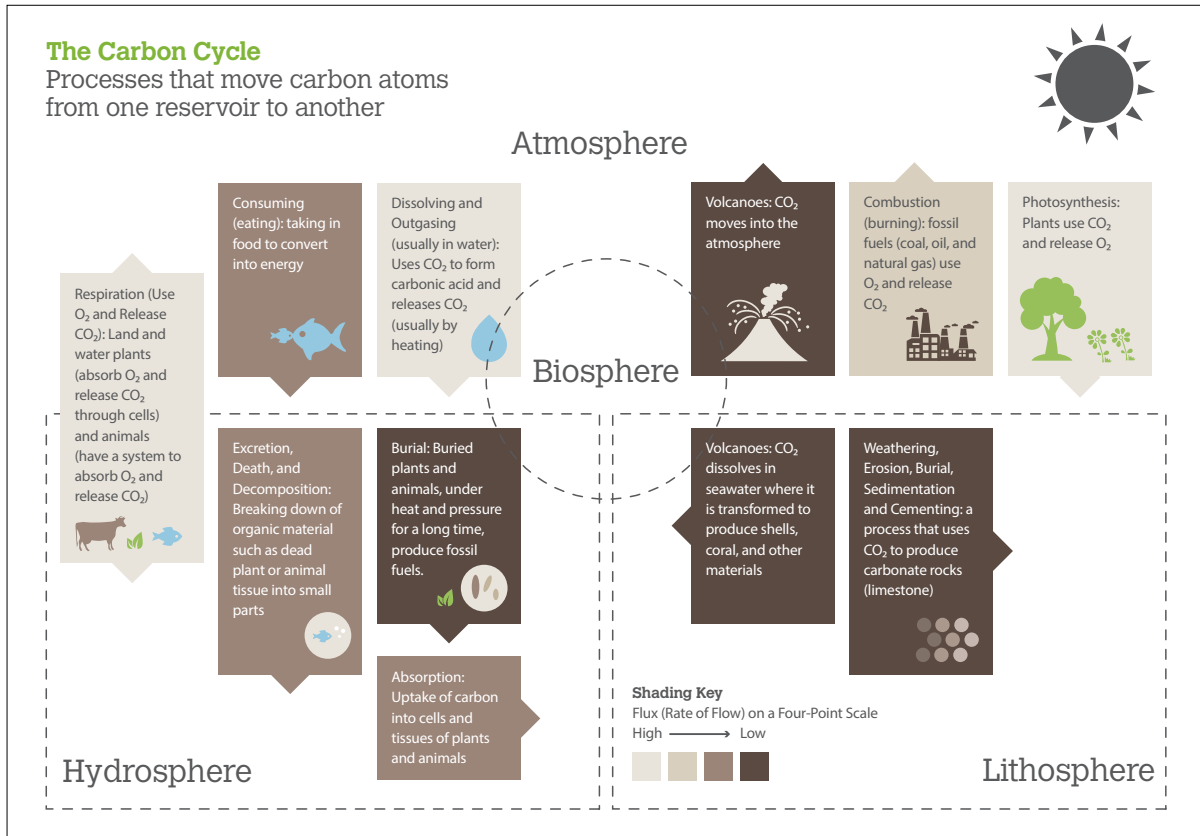
Energy transfers (e.g. from the ball to the drum)	Energy transformations (e.g. from kinetic energy to sound energy)

Source:

Dornswalo Wilkins-McCorey 2013, *The most outrageous way to share a Coke*, [Online Video] 24 July, viewed 31 December 2013, <<http://youtu.be/Kc8TCivr10U>>

## The power of carbon!

### Energy transfers and transformations in the carbon cycle



There are many energy transfers and transformations that occur when carbon moves between the different spheres of the carbon cycle.

A good example of this is when carbon moves from being stored as fossil fuel in the lithosphere (e.g. as coal underground) to becoming carbon dioxide in the atmosphere. This is also known as burning or combustion.

- > Can you find combustion on the carbon cycle diagram above? Circle it on the diagram
- > Can you identify any other energy transfers or transformations that occur as carbon moves between the spheres in the carbon cycle? List them in the space below.

Source:  
WithOnePlanet, *energy transfer* infographics 2015.

## It's all about carbon

Watch the following two videos about carbon and then answer the questions below.



Episode 2: *Global Warming, It's all about carbon* from YouTube  
<http://youtu.be/cOJ3MUpDrfl><sup>1</sup>




**Q1:** What happens when carbon latches onto other atoms, such as hydrogen and oxygen?

**Q2:** What is so special about two carbon atoms when they lock together?

Source:

1. NPR 2009, Episode 2: Global Warming, It's All About Carbon, [Online Video] 3 February, viewed 31 December 2013, <<http://youtu.be/cOJ3MUpDrfl>>.

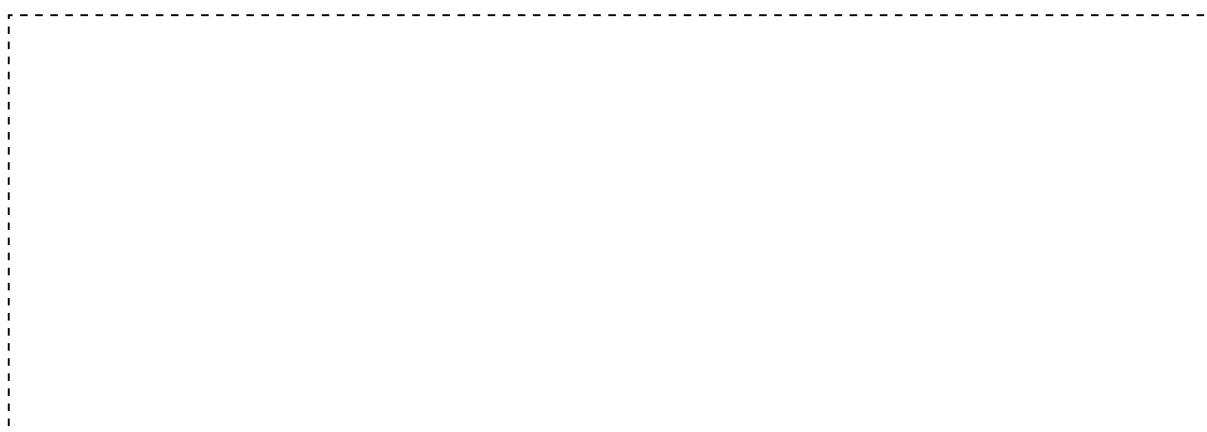
**Q3:** Why are some fuels called fossil fuels?



**Q4:** How was oil formed in the Middle East?



**Q5:** How is coal similar to oil? How is it different from oil?

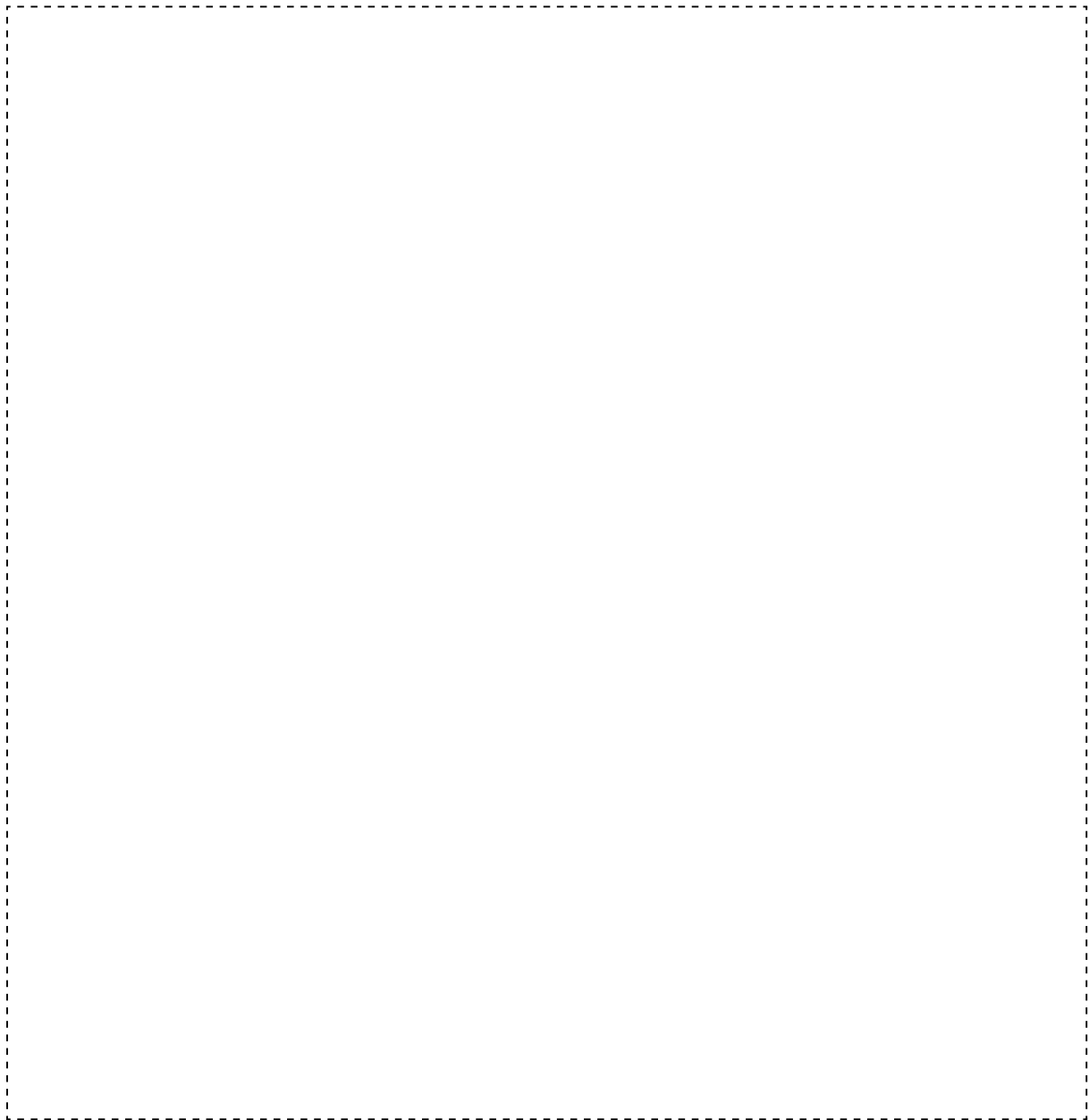


## Making electricity from fossil fuels

Fossil fuels – coal, oil and natural gas – are huge stores of carbon underground. Over time, particularly since the beginning of the Industrial Revolution around 1760 AD, humans have developed more and more sophisticated ways of digging up those carbon stores and burning them to release energy.

The energy released from the combustion of fossil fuels is heat energy. Heat energy is a very inefficient form of energy – it is hard to contain, store, transport or do anything much with. So humans invented power stations so that they could transform the heat energy from fossil fuels into electrical energy.

What are some of the advantages of electricity over other forms of energy?



The following 4 interactives from the E.ON UK Energy Experience will give you a clearer idea about how electricity is produced from fossil fuels.

## 1. Build your own power station

Regardless of its type, the job of a power station is to transform a particular form of energy into electrical energy. Power stations use a chain of energy transformations to do this.

Your task in this interactive is to use your knowledge of energy transformations to build your own power station.

Choose one of coal, oil or gas to start and then select the components that you think will give you a working chain of energy transformations that ends with electricity.

Once you have completed the first fossil fuel, try completing the task for the other two.

> Build your own power station: <http://www.eon-uk.com/EnergyExperience/708.htm> 3

## 2. Non-renewable sources of energy: coal, oil and natural gas

In this interactive, you will be presented with a variety of different 'power schemes'. Select one of coal, oil or natural gas and put together the correct set of energy transformations to power it up! (You will need to think very carefully about where all the energy in these resources comes from in the first place!)

> Energy sources: <http://www.eon-uk.com/EnergyExperience/481.htm> 4 (Then click on Start the generation game activity)

Use the information in the interactive and by clicking on the i icon complete the tables on the following three pages.



**Coal** Inside a coal-fired power station ...

<p>What happens at each of the stages of electricity generation from coal? <i>(roll over the red numbers to find out)</i></p>	<p>Traditional coal <i>(Click on the icon to find out more about traditional coal)</i></p>
<p>1.</p>	<p>Status:</p>
<p>2.</p>	<p>How was it formed?</p>
<p>3.</p>	<p>Advantages:</p>
<p>4</p>	<p>Disadvantages:</p>
<p>5.</p>	<p>The future:</p>



**Oil** Inside a oil-fired power station ...

<p>What happens at each of the stages of electricity generation from oil? <i>(roll over the red numbers to find out)</i></p>	<p>Traditional coal <i>(Click on the i icon to find out more about traditional coal)</i></p>
<p>1.</p>	<p>Status:</p>
<p>2.</p>	<p>How was it formed?</p>
<p>3.</p>	<p>Advantages:</p>
<p>4</p>	<p>Disadvantages:</p>
<p>5.</p>	<p>The future:</p>

**Gas** Inside a gas-fired power station ...

<p>What happens at each of the stages of electricity generation from gas? <i>(roll over the red numbers to find out)</i></p>	<p>Traditional coal <i>(Click on the i icon to find out more about traditional coal)</i></p>
<p>1.</p>	<p>Status:</p>
<p>2.</p>	<p>How was it formed?</p>
<p>3.</p>	<p>Advantages:</p>
<p>4</p>	<p>Disadvantages:</p>
<p>5.</p>	<p>The future:</p>

### 3. Tour of a power station

Refresh your memory about what happens inside a coal-fired power station and then find out more about how the electricity that is generated there gets to our homes.

> Tour of a power station – <http://www.eon-uk.com/EnergyExperience/164.htm><sup>5</sup>

Answer the questions about how electricity gets to our homes in the spaces provided.

**Q1:** Where does the electricity go when it leaves the power station?

**Q2:** What does a transformer do and why is this necessary?

**Q3:** What is a national grid?

**Q4:** What happens at a substation?

**Q5:** Electricity travels to and from the substation via cables. How are cables themselves and the electricity within these cables different when travelling towards compared to when travelling away from the substation?

**Q6:** How is the amount of electricity used by a household monitored?

Sources:

1. NPR 2009, Episode 2: *Global Warming, It's All About Carbon*, [Online Video] 3 February, viewed 31 December 2013, <<http://youtu.be/cQJ3MUpDrfl>>
2. NPR 2009, Episode 3: *Global Warming, It's All About Carbon*, [Online Video] 3 February, viewed 31 December 2013, <<http://youtu.be/Q9u8vM8YjeU>>
3. E.ON UK 2013, E.ON UK - *Energy Experience - Energy*, viewed 31 December 2013, <<http://www.eon-uk.com/EnergyExperience/708.htm>>
4. E.ON UK 2013, E.ON UK - *Energy Experience - Energy* – Energy, viewed 31 December 2013, <<http://www.eon-uk.com/EnergyExperience/481.htm>>
5. E.ON UK 2013, E.ON UK - *Energy Experience - Energy* – Energy, viewed 31 December 2013, <<http://www.eon-uk.com/EnergyExperience/164.htm>>