

5 Alternative energy

Switch on

Identify these sources of alternative energy. Work in groups and discuss how each can be used to replace fossil fuels like oil, gas, and coal.



Listening

Wave Energy Innovator



- 1 You are going to hear a radio programme about wave energy. Before you listen, work in groups and discuss the questions.
 - 1 Look at the picture, what do you think this is?
 - 2 What problems are there in using wave energy?
 - 3 What is a wave farm?
 - 4 What are carbon emissions?
 - 5 What does it mean if a project is *commercially viable*?
- 2 Now listen to the programme and answer the questions.
 - 1 What does Richard's company make?
 - 2 How much power will the wave farm produce when complete?
 - 3 Where did Richard study?
 - 4 What names have people given to previous wave converters?
 - 5 Why did Richard call it Pelamis?
 - 6 How did Richard find the name?
- 3 Listen again and note the answers to the questions.
 - 1 How does he describe Stephen Salter?
 - 2 What expression does Richard use which means 'talking endlessly about something'?
 - 3 What expression does Richard use which means 'follow up your words with action'?
 - 4 What does Richard feel about 'making clever things'?
 - 5 His company has two objectives. One is to earn revenue for people. What is the other?

In this unit

- key terms in alternative energy
- Past Continuous v Past Simple
- making inferences from written text
- strategies for remembering technical words

● Language spot

Past Continuous v Past Simple

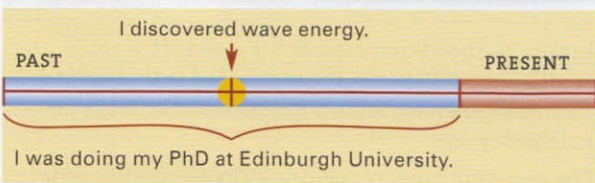
- Study this example:

*I **discovered** wave energy when I **was doing** my PhD at Edinburgh University.*

- We use the Past Continuous for an action in progress in the past when something else happened, or to describe the background to an account or report.

- We use the Past Simple for a complete action in the past.

- These tenses are often used together when one action comes in the middle of another longer action. Sometimes this is signalled by time words such as *while*, *when*, or *as* before the longer action.



- We use the Past Simple for a series of past actions. *We **did** a quick Google search on sea snakes and **found** Pelamis.*

- We normally use the Past Simple, not the Past Continuous, to describe states and actions which take very little time. *And we **liked** that.*

*I **saw** that people were doing something really important.*

*The accident **happened** suddenly.*

» Go to **Grammar reference** p.116.

- 1 Match phrases 1–6 with phrases a–f to make sentences. Put one verb in the Past Continuous and the other in the Past Simple.

- | | |
|--|------------------------------------|
| 1 When they (dig) under London, | a while most people (sleep). |
| 2 Rutherford (work) in Manchester | b he (meet) Professor Salter. |
| 3 The earthquake (happen) late at night, | c they (have) to alter the design. |
| 4 As it (come in) to land, | d part of the tunnel (collapse). |
| 5 When Richard (study), | e the aircraft (crash). |
| 6 When they (construct) the bridge, | f when he (split) the atom. |

- 2 Put the verb in brackets in the appropriate tense – Past Continuous or Past Simple.

- We _____ (do) a Google search and _____ (find) the answer very quickly.
- When he _____ (work) in Nigeria, there _____ (be) a serious accident on the oil rig.
- When Trevor Baylis _____ (hear) about communication problems in Africa, he _____ (decide) to build a radio without batteries.
- While the operation _____ (go on) in France, doctors in other countries _____ (be able to) assist using telesurgery.
- The police _____ (use) a Taser gun because they _____ (think) the suspect might hurt someone.
- He _____ (not wear) a hard hat when the accident _____ (happen), so he hurt his head.
- The motor _____ (run) when he _____ (remove) the guards. It was a stupid thing to do.
- The accident _____ (be) his own fault. He _____ (use) a grinder without wearing eye protection when it _____ (happen).
- While the generator _____ (run), a fault _____ (develop) in the main bearing.
- As they _____ (build) the wind farm, protestors _____ (damage) some equipment.

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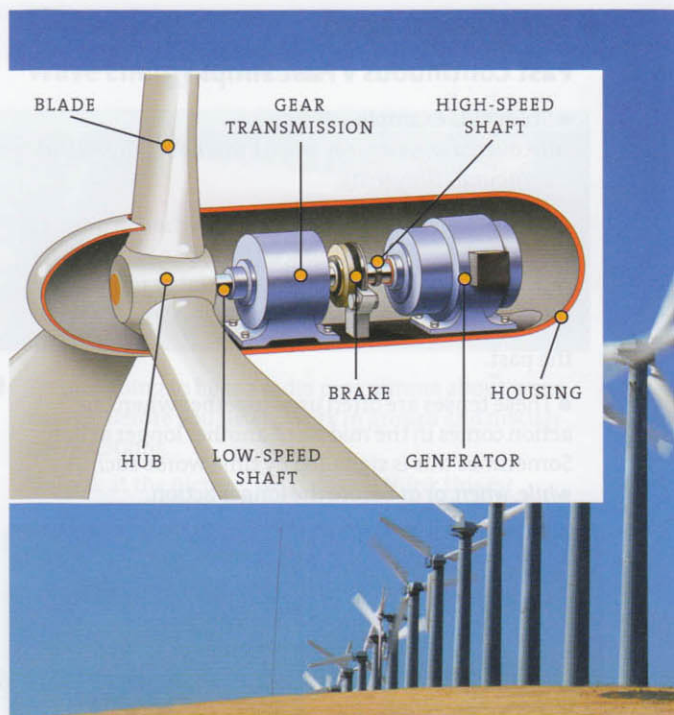
Reading

Making inferences

- 1 Match components 1–8 with their functions a–h with the help of this simplified diagram of a wind turbine.

A	B
1 hub	a transfers power to the generator
2 blades	b links the blades to the low-speed shaft
3 gear transmission	c contains the main components
4 high-speed shaft	d stops the turbine
5 generator	e capture the wind energy
6 housing (nacelle)	f increases the speed of the shaft
7 brake	g relays power to the gear transmission
8 low-speed shaft	h produces electricity

- 2 Now read the text and check your answers to 1.



Wind power

Wind power is renewable and non-polluting and can be used to drive wind turbines like the one illustrated. Wind farms consisting of numbers of turbines are increasingly being constructed both on land, usually on high ground, and offshore.

Wind speeds increase with height, so turbines are mounted on towers, typically 50 to 80 metres in height. Most towers are tubular to allow safe access for maintenance.

The rotor blades capture the wind and transfer its power to the rotor hub, which is attached to the low-speed shaft of the turbine. Each rotor blade measures about 27 metres in length and is designed much like an aeroplane wing. The rotor rotates quite slowly, at about 30 r.p.m.

The nacelle, the casing at the top of the tower, contains the most important components including the gearbox, generator, and computer. The low-speed shaft transmits power from the hub to the gearbox. It contains pipes for the hydraulic system, which operates the aerodynamic

brakes. The gearbox increases the speed of the rotor shaft by about 50 times. The high speed shaft drives the electrical generator. It has a mechanical disc brake for emergency use.

The generator produces electricity by electromagnetic induction. On a large turbine, the power generated is between 600 kW and 3,000 kW. The power is sent by cable to the national grid.

The anemometer and wind vane on top of the nacelle measure the speed and direction of the wind respectively and send this information to the computer. The computer activates the yaw motor, which turns the rotor into the wind. It starts the turbine when the wind reaches about five metres per second. The computer continuously monitors the conditions of the turbine. It controls the speed of the rotor by varying the pitch of the blades. If the wind reaches storm force, about 25 metres per second, the computer closes down the turbine to prevent damage.

Gadget box

Photovoltaic roof tiles not only keep the rain out, but generate 50 watts of electricity for every 0.5m^2 of tiles. What area would you need to power an average home?



- 3 Put the sentences in the correct order to describe the operation of the turbine.
- The computer uses the yaw drive to turn the turbine into the most effective position. _____
 - The gearbox increases the speed of the rotor shaft by 50 times. _____
 - The high-speed shaft drives the electric generator. _____
 - The wind strikes the blades which turn the low-speed shaft. _____
 - The power is sent by cable to the national grid. _____
 - The generator converts the mechanical energy into electrical power. _____
 - The anemometer and wind vane determine the wind speed and direction and transmit this to the computer. _____
 - The computer starts the turbine when wind speed reaches 5 m/s . _____

Making inferences

Sometimes the information we want when we read is not stated clearly in the text. We have to infer it. That means we have to work it out by linking different pieces of information in the text or by combining text information with our knowledge of the text topic. For example:

Question What are the best places on land to build a wind farm and for what reasons?

- Information from the text:
 - usually on high ground*
 - wind speeds increase with height*
- From our knowledge of the text topic:
 - preferably near existing transmission lines to save costs*

Possible answer *On high ground, because wind speeds are greatest, and preferably near existing transmission lines to save costs.*

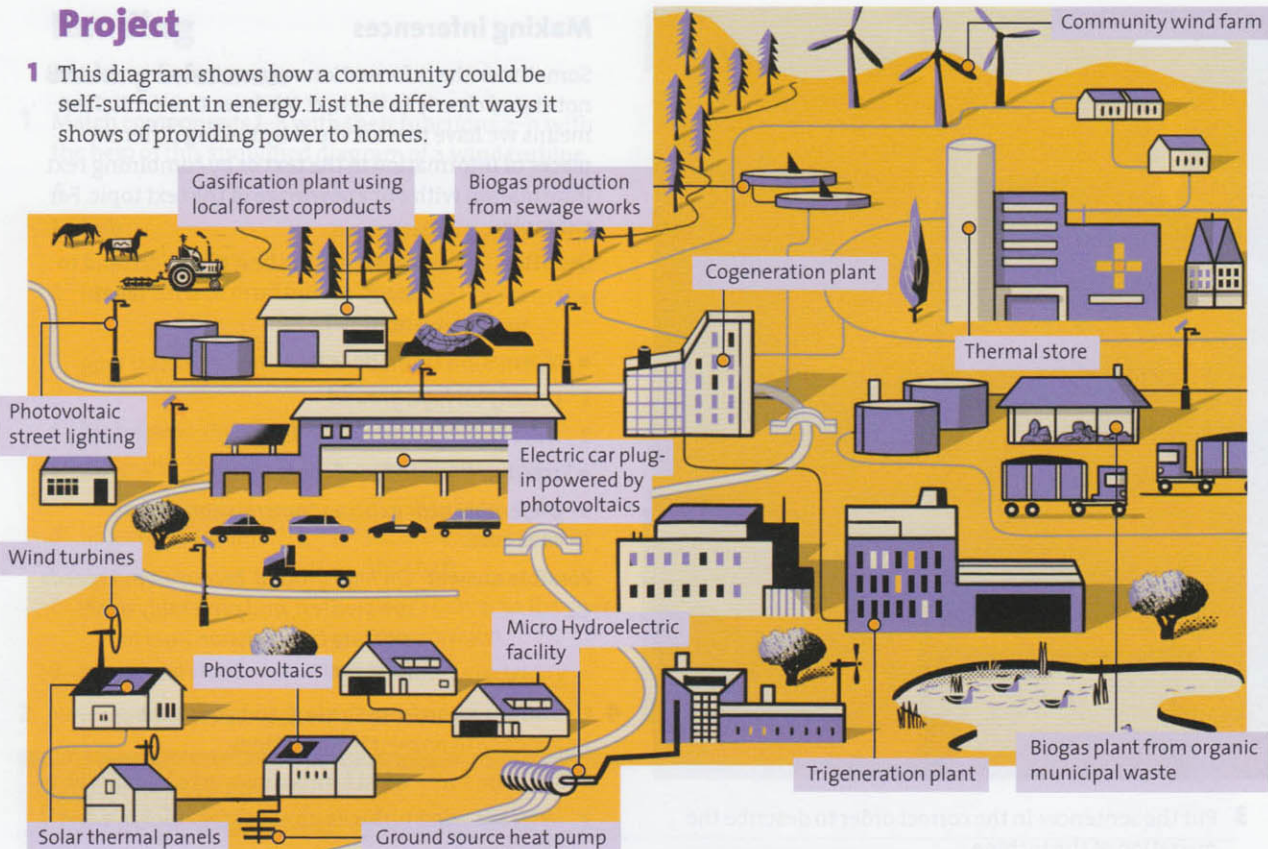
- 4 Use information from the text and your own knowledge to answer the questions.
- Why are some wind farms constructed offshore?
 - Why are wind turbines grouped together in wind farms?
 - Why do tubular towers provide safer access than some other kinds of tower?
 - What is the approximate diameter of the wind turbine rotor in the picture?
 - At what speed does the high-speed shaft rotate?
 - Why is a gearbox necessary?
 - What is the maximum output from this type of generator?
 - What is the difference between the anemometer and the wind vane?
 - Why does the yaw mechanism turn the turbine into the wind?
 - What is storm force in km/h ?

Nuclear energy may just be the energy source that can save our planet from catastrophic climate change.

Patrick Moore, co-founder of Greenpeace

Project

- 1** This diagram shows how a community could be self-sufficient in energy. List the different ways it shows of providing power to homes.



- 2** What do you think these features shown on the diagram are? Check your answers with a good technical dictionary or use Google. (Tip: enter **define:** followed by the unknown term.)

- | | |
|------------------------|------------------------|
| 1 a cogeneration plant | 3 a gasification plant |
| 2 a trigenation plant | 4 a thermal store |

- 3** Find the answers to the questions.

- How is street lighting powered?
- What is organic waste used for?
- Why is it an advantage to be near woods, hills, and a river?
- What kind of private transport is used?

- 4** With a partner list the forms of energy shown in the diagram which could be used to make your own community more self-sufficient in energy. Give reasons for those you choose and those you reject.

Webquest

Work in groups. Research one of these topics and report your findings to the rest of the class.

- Avedøre-2 multi-fuel power plant, Denmark
- Trigenation
- Combined Heat and Power (Cogen) use in Rotterdam
- Renewable energy projects in Malmö, Sweden
- Thermal stores

These sites may help:

www.cogeneration.net/TrigenationExplanation.htm
www.power-technology.com/projects/avedore/
www.enecho.meti.go.jp/english/energy/

UK Department of Trade and Industry:

www.dti.gov.uk/renewable/

Danish Wind Industry Association:

www.windpower.org/en/

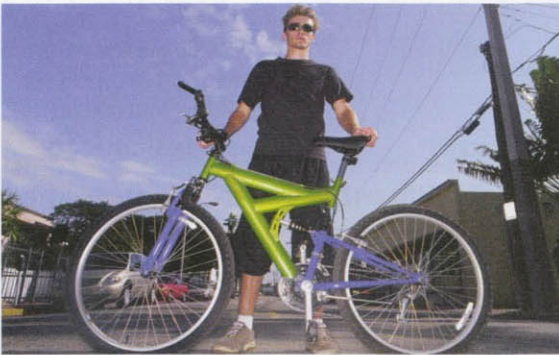
Vocabulary

Grouping words

One way to remember your growing technical vocabulary is to group words into sets, for example words which describe shapes, treatments, or properties of materials.

- 1 These verbs all describe movement in mechanisms. Use each verb once to complete sentences 1–8, which describe the mechanism in the picture.

drive rotate stop transmit
increase/decrease start transfer turn



- The pedals _____ power to the chain wheel.
- The chain _____ power to the rear wheel.
- The gears _____ or _____ the speed of rotation of the rear wheel.
- Each time the chain wheel turns, the rear wheel _____ three times.
- At 30 km/h., the chain wheel _____ at 238 r.p.m.
- To _____ the bicycle, use the brakes.
- When you _____ to pedal, you have to overcome static friction.
- The front wheel _____ the dynamo.

Another way is to remember word partners, words which go together like *fossil + fuel*.

- 2 Each of these words is used with *energy*. Separate them into words which go before and words which come after *energy*.

change conversion mechanical solar
chemical electrical nuclear
conservation heat potential

Checklist

Assess your progress in this unit. Tick (✓) the statements which are true.

- ☐ I know the English words for alternative energy sources
- ☐ I know the important differences between the Past Continuous and the Past Simple
- ☐ I can make inferences when I read
- ☐ I know ways of remembering technical words
- ☐ My reading and listening are good enough to understand most of each text in this unit

Key words

Adjective

commercially viable

Adverb

offshore

Nouns

carbon emissions
converter
fossil fuel
gearbox
hydraulic system
renewable energy
turbine
wave
wind

Verbs

activate
collapse
convert
transmit

Note here anything about how English is used in technology that is **new** to you.