

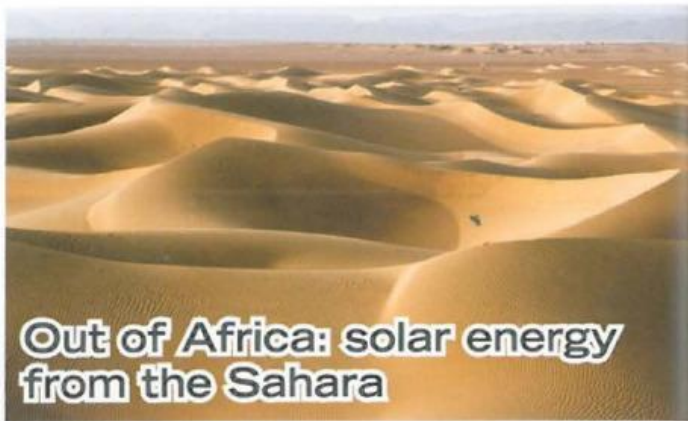
Reading 1

Reading Section 2

① Work in pairs. You are going to read an article about a form of renewable energy. Before you read, look at the title and the subheading and answer these questions.

- 1 What do you think the article will be about?
- 2 What problems do you think there might be with producing electricity in this way?

② Now read the article quite quickly to find three problems with producing electricity in the Sahara.



Vivienne Walt reports on how the Sahara Desert could offer a truly green solution to Europe's energy problems

- A For years, the Sahara has been regarded by many Europeans as a *terra incognita** of little economic value or importance. But this idea may soon change completely. Politicians and scientists on both sides of the Mediterranean are beginning to focus on the Sahara's potential to provide power for Europe in the future. They believe the desert's true value comes from the fact that it is dry and empty. Some areas of the Sahara reach 45 degrees centigrade on many afternoons. It is, in other words, a gigantic natural storehouse of solar energy.
- B A few years ago, scientists began to calculate just how much energy the Sahara holds. They were astonished at the answer. In theory, a 90,600 square kilometre chunk of the Sahara – smaller than Portugal and a little over 1% of its total area – could yield the same amount of electricity as all the world's power plants combined. A smaller square of 15,500 square kilometres – about the size of Connecticut – could provide electricity for Europe's 500 million people. 'I admit I was sceptical until I did the calculations myself,' says Michael Pawlyn, director of Exploration Architecture, one of three British environmental companies comprising the Sahara Forest Project, which is testing solar plants in Oman and the United Arab Emirates. Pawlyn calls the Sahara's potential 'staggering'.
- C At the moment, no one is proposing the creation of a solar power station the size of a small country. But a relatively well-developed technology exists, which proponents say could turn the Sahara's heat and sunlight into a major source of electricity – Concentrating Solar Power (CSP). Unlike solar panels, which convert sunlight directly into electricity, CSP utilises mirrors which focus light on water pipes or boilers to produce very hot steam to operate the turbines of generators. Small CSP plants have produced power in California's Mojave Desert since the 1980s. The Sahara Forest Project proposes building CSP plants in areas below sea level (the Sahara has several such depressions) so that sea water can flow into them. This water would then be purified and used for powering turbines and washing dust off the mirrors. Waste water would then supply irrigation to areas around the stations, creating lush oases – hence the 'forest' in the group's name.



North African plants begin operating, by linking a few cable lines under the Med. 'I call it the Lego method,' he says. 'Build it piece by piece.' If it can be shown that power from the Sahara can be produced profitably, he says, companies and governments will soon jump in. If they do, perhaps airplane passengers flying across the Sahara will one day count the mirrors and patches of green instead of staring at sand.

adapted from *Time Magazine*

*terra incognita – Latin, meaning 'an unknown land'

- D But producing significant quantities of electricity means building huge arrays of mirrors and pipes across hundreds of miles of remote desert, which is expensive. Gerry Wolff, an engineer who heads DESERTEC, an international consortium of solar-power scientists, says they have estimated it will cost about \$59 billion to begin transmitting power from the Sahara by 2020.
- E Building plants is just part of the challenge. One of the drawbacks to CSP technology is that it works at maximum efficiency only in sunny, hot climates – and deserts tend to be distant from population centres. To supply Europe with 20% of its electricity needs, more than 19,300 kilometres of cables would need to be laid under the Mediterranean, says Gunnar Asplund, head of HVDC research at ABB Power Technologies in Ludvika, Sweden. Indeed, to use renewable sources of power, including solar, wind and tidal, Europe will need to build completely new electrical grids. That's because existing infrastructures, built largely for the coal-fired plants that supply 80% of Europe's power, would not be suitable for carrying the amount of electricity generated by the Sahara. Germany's government-run Aerospace Centre, which researches energy, estimates that replacing those lines could raise the cost of building solar plants in the Sahara and sending significant amounts of power to Europe to about \$465 billion over the next 40 years. Generous government subsidies will be needed. 'Of course it costs a lot of money,' says Asplund. 'It's a lot cheaper to burn coal than to make solar power in the Sahara.'
- F Meanwhile, some companies are getting started. Seville engineering company Abengoa is building one solar-thermal plant in Algeria and another in Morocco, while a third is being built in Egypt by a Spanish–Japanese joint venture. The next step will be to get cables in place. Although the European Parliament has passed a law that aids investors who help the continent reach its goal of getting 20% of its power from renewable energy by 2020, it could take years to create the necessary infrastructure.
- G Nicholas Dunlop, secretary-general of the London-based NGO e-Parliament, thinks companies should begin transmitting small amounts of solar power as soon as the

3 Read the instructions for Questions 1–5 below and answer these questions. Then underline the key ideas in Questions 1–5.

- 1 Will you need to use all the letters, A–G, in your answers?
- 2 Can you use the same letter for more than one answer?

Questions 1–5

The reading passage has seven paragraphs, A–G. Which paragraph contains the following information?

Write the correct letter, A–G.

NB You may use any letter more than once.

- 1 a mention of systems which could not be used
- 2 estimates of the quantity of power the Sahara could produce
- 3 a suggestion for how to convince organisations about the Sahara's potential
- 4 a short description of the Sahara at present
- 5 a comparison of the costs of two different energy sources

4 Now read the article and answer Questions 1–5.

Exam advice Matching information

- Read the instructions carefully.
 - You will not need all the paragraphs for your answers.
 - You may be able to find two of the answers in the same paragraph.
- Read the questions carefully.
 - Underline the key ideas in each of them.
 - Quickly find the right part of the passage and read carefully to make sure it covers the information.

5 Look at Questions 6–9 and the list of organisations below.

- 1 Read the passage very quickly and underline where each organisation on the list is mentioned.
- 2 Read the statements and underline the key ideas.
- 3 Carefully read the parts of the article where each organisation is mentioned and decide whether a statement matches this.

Questions 6–9

Look at the following statements (Questions 6–9) and the list of organisations below.

Match each statement with the correct organisation, A–G.

- 6 They have set a time for achieving an objective.
- 7 They believe that successful small-scale projects will demonstrate that larger projects are possible.
- 8 They have a number of renewable energy projects under construction.
- 9 They are already experimenting with solar-energy installations in other parts of the world.

List of Organisations

- A Exploration Architecture
- B DESERTEC
- C ABB Power Technologies
- D Aerospace Centre
- E Abengoa
- F The European Parliament
- G e-Parliament

Exam advice Matching features

- Sometimes there are more options than questions; they are listed in the order they appear in the passage. Quickly locate them and underline them.
- Underline the key ideas in each question.
- Read carefully what the passage says about each option and match each question to one option.

6 Look at Questions 10–13 below.

- 1 What type of information do you need to complete each gap?
- 2 Which paragraph in the article deals with Concentrating Solar Power? Read it and complete the gaps.

Questions 10–13

Complete the summary below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

Concentrating Solar Power (CSP)

Unlike solar panels, CSP concentrates the sun's rays on boilers by using **10** The resulting heat produces high-temperature **11**, which in turn moves the turbines which generate electricity. CSP plants will be situated in **12** to allow sea water to run in. This, when purified, can be used to wash the equipment. The resulting dirty water will be used for **13** around the power plant, and in this way oases will be formed.



Exam advice Summary completion

- Read the summary carefully first.
- Use the title to find the correct section of the passage, then read it carefully.
- Check your summary when you have finished.

7 Work in small groups.

- What renewable energy is used in your country?
- Why is renewable energy better than other sources of energy?
- What disadvantages does renewable energy have?

Reading 2

Reading Section 2

- ① Read through the text about Russia's boreal forests briefly and look at Questions 6–9.

In which sections of the text are the scientists on the list mentioned?

- ② Now read the text carefully and answer Questions 1–13.

Russia's boreal forests and wild grasses could combat climate change

- A** Scientists believe Russia's ancient forests are the country's best natural weapon against climate change, even though the stockpile of carbon beneath the ground also makes these areas vulnerable to carbon release. A recent study found that half the world's carbon is stored within land in the permafrost region, about two-thirds of which lies in Russia. Overlying former glaciers, they are a coniferous mix called the boreal forest. 'There's a lot of carbon there and it's very vulnerable,' says Josep Canadell, co-author of the study. 'If the permafrost thaws, we could be releasing ten percent more carbon a year for several centuries more than our previous models predicted. It's going to cost a lot to reduce our emissions by that much – but it will cost more in damage if we don't.'
- B** The study was published in *Global Biogeochemical Cycles*. Researchers found that the region contains 1,672 billion tons of organic carbon, much of it several feet underground, that 'would account for approximately 50 percent of the estimated global below-ground organic carbon'. Another paper published in *Nature* found that old forests, which make up perhaps half of the boreal forest, 'continue to accumulate carbon, contrary to the long-standing view that they are carbon-neutral'. Even though fires and insect infestations destroy entire swaths of forest and release into the atmosphere the carbon they contain, old-growth forests still take in more than these natural disturbances release, says lead author Sebastiaan Luyssaert, a biologist at the University of Antwerp in Belgium. 'This is all the more reason to protect Russia's boreal forests,' which take in 500 million tons of carbon a year, or about one-fifth of the carbon absorbed by the world's landmass, says Mr Canadell, who is executive director of the Global Carbon Project, based in Canberra.



- C** Jing Ming Chen, a University of Toronto geography professor who specialises in climate modelling for the boreal region, says: 'Cutting boreal trees increases the amount of carbon in the atmosphere and it takes 50 to 100 years to put that carbon back in the ground.' Luyssaert and Chen argue there's a strong case for conserving the old-growth forests. 'It's better to keep as much carbon in the forest as possible right now,' Mr Luyssaert explains. 'If we want to avoid irreversible processes like melting permafrost or changing ocean currents, we absolutely have to control our emissions in the next two or three decades. It's a case where you need to be short-sighted to be far-sighted.' The threats to the boreal forests don't seem significant right now,' explains Nigel Roulet, a carbon cycle specialist at McGill University in Montreal, 'but I'm convinced pressure will increase as the region gets warmer and it gets easier to operate there. Also, I expect these resources to become more valuable as others are exhausted.'
- D** Scientists say Russia and Kazakhstan could make a unique contribution to the fight against global warming by harvesting wild grasses that have overgrown 100,000 square miles of agricultural lands abandoned in the nineties, and using them to make ethanol – or, better yet, burn them in coal-fuelled power plants. According to Nicolas Vuichard, principal author of a paper published in *Environmental Science and Technology* of Washington, DC, using the grasses to make ethanol would sequester in the ground, over 60 years, about 10 million tons of carbon a year – one-quarter as dead root matter in the soil and the rest in producing ethanol as a substitute for petroleum-based fuels. 'That's not huge on a world scale, but it's substantial,' he says. Fossil fuels emit about eight billion tons of carbon a year, of which about two billion tons are absorbed by plants and soil.

E Renton Righelato, visiting research fellow at the University of Reading and former chairman of the World Land Trust, agrees. 'Given that it would take the world's entire supply of arable land to replace just two-thirds of our transport fuel needs,' he says, 'biofuels are not a practicable long-term solution for transportation emissions. What we need is carbon-free fuel. But in the case of abandoned croplands, using grasses as biofuels could make a contribution,' he adds. Study co-author Adam Wolf, of the Carnegie Institution for Science at Stanford University, cites a study by Elliott Campbell in *Science* magazine that showed that burning grasses in a coal-fuelled plant doubles the savings in carbon emissions compared to using the same grasses to make ethanol. 'If biofuels are going to reduce emissions, using abandoned croplands to make electricity and offset coal use is our best bet,' he says. 'Both of these countries have coal-fuelled power plants, so the process could start soon.' Thus, Russia and Kazakhstan are now in a position to become leaders in green energy, and could use the grasses to export clean electricity in addition to oil and gas, according to Mr Wolf.

Questions 1–5

The reading passage has five paragraphs, A–E. Which paragraph contains the following information?

Write the correct letter, A–E.

NB You may use any letter more than once.

- 1 a view concerning what can and what cannot replace something
- 2 a mention of the amount by which carbon emissions might increase in the future
- 3 a reference to an established belief that researchers say is incorrect
- 4 evidence from one study that supports the conclusions of another study
- 5 how much carbon is currently located in a particular part of the world

Questions 6–9

Look at the following statements (Questions 6–9) and the list of scientists below.

Match each statement with the correct scientist, A–D.

- 6 More attention will be paid to the situation in the boreal forests in the future.
- 7 Boreal forests are able to deal with some of the damage that is done to them.
- 8 Earlier research may have underestimated the scale of a future problem.
- 9 The damage done by destroying boreal forests lasts for a very long time.

List of scientists

- | | |
|------------------------|------------------|
| A Josep Canadell | C Jing Ming Chen |
| B Sebastiaan Luyssaert | D Nigel Roulet |

Questions 10–13

Complete the summary below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

Wild grasses in Russia and Kazakhstan

Scientists believe that wild grasses which are currently growing on former 10 in Russia and Kazakhstan could be useful in combating environmental problems. There are two different ideas concerning how this could happen.

With the first idea, approximately ten million tons of carbon would be stored in the ground, and three-quarters of this would create 11 that could be used instead of petroleum-based fuels. The second idea is to burn the grasses in 12 power plants. Supporters of this idea say that the effect in reducing carbon emissions would be twice as great as if the first idea was carried out. The grasses would be used to produce 13 and production of this could begin in a short period of time.

Vocabulary

Art appreciation

- 1.1** Which art forms are shown in these pictures?
What do we call the people who do these things?



- 1.2** Which of these art forms do you find the most and least appealing?

- 1.3** Read the text making sure you understand the meaning of the words in bold. Use a dictionary if necessary.

The brain of the beholder

The cave figures of Lascaux, Leonardo da Vinci's *Mona Lisa*, a Cubist painting by Pablo Picasso and the African **artefact** that **inspired** Picasso's work. These works of art are separated by great gulfs in time, different social and political systems, and language divides. Yet despite these variations, there is art in each place and era. That there is a seemingly **universal impulse** to express oneself this way suggests that human beings are neurologically hardwired for art.

Imagine yourself in the Louvre in Paris, pushing through the throngs to behold the Mona Lisa's enigmatic smile. Or recall the first time you ever saw the Sydney Opera House. Most likely your skin tingled, you felt a thrill and you paused for a moment of **reflection**. Even glimpses of **mundane** objects such as the latest curvaceous kettle, can inspire something similar. Art and design critics will describe how formal qualities like proportion are **choreographed** to produce the viewer's **rush**. But the fact that **aesthetic** experience can inspire such a biological response suggests that it's a stimulus neuroscientists could analyse just as **deftly**.

And that's exactly what they are doing. In laboratories and galleries around the world, researchers are showing how the organisation of the brain relates to the **conception** and experience of art. This is the **burgeoning** field of neuroaesthetics, in which scientists are discovering that – rather than **transcending** the ordinary – art and aesthetics are part of everyday experience. They're also finding that, in some **fundamental** ways, art really is an expression of human nature.

- 1.4** Write **Yes** if these statements agree with the information in the text or **No** if the statements contradict the information. Write the words in bold that helped you with your answer.

- 1 Pablo Picasso got the idea for one of his paintings from an ancient work of art from Africa.
Yes – **artefact**, **inspired**
- 2 The desire to create art is limited to certain parts of the world.
- 3 When people look at works of art it provokes serious and careful thought.
- 4 Ordinary objects can be aesthetically pleasing.
- 5 Art critics believe that artistic elements are arranged and combined together in order to create a feeling of excitement.
- 6 Researchers are analysing how the brain creates the idea of art.
- 7 Neuroaesthetics is failing to catch on in the world of science.
- 8 Scientists have discovered that art is a way of rising above everyday life.