

T H E M E

energy



1

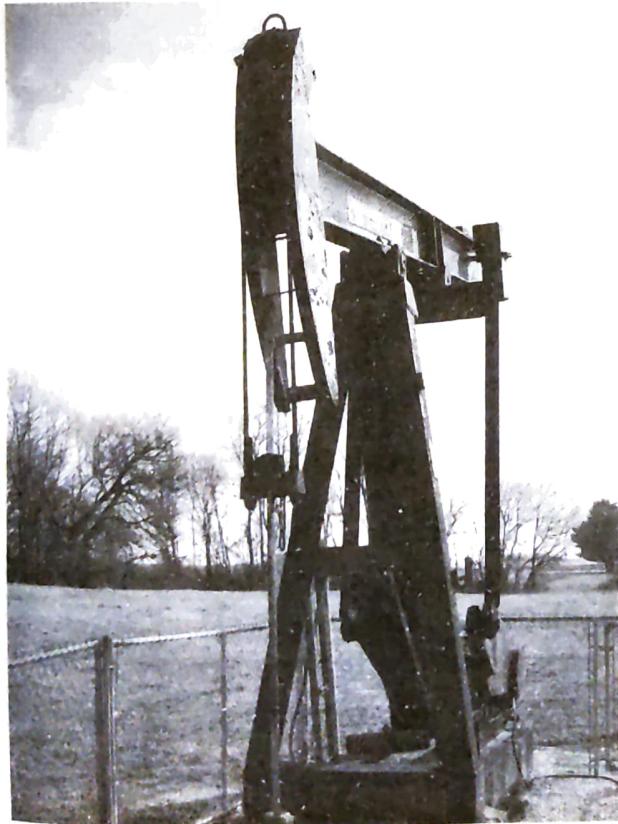


OIL



Preparation

❖ Oral practice



a

Interview another student about the region he or she comes from. Begin your questions like this:

Could you tell me something about your district?

- What about?
- Do you?
- How has developed in your?
- Have there been many/any changes in?

b

Now imagine that you are going to interview someone from the Middle East.

Write as many questions as you can, in the time given, about the development, culture and way of life. Use the questions listed above if necessary.

OIL AND ALTERNATIVE SOURCES



Speaker X: How will we meet our energy needs in the future?

We cannot have oil for all time.

Speaker Y: We appear to be entering a particularly innovative period, with more than one path to a sustainable energy system.

Speaker X: Predicting the future is easy – getting it right is the hard part. Twenty-five years after the automobile was invented, we are still continuing to ask searching questions about the world's future energy needs.

Speaker Y: We can think about the different choices and possibilities that might arise within the commercial energy system during the next 50 years and develop scenarios to help us understand how energy systems could evolve during that time. This is the approach we should use to think about how today's energy industry might evolve.

Speaker X: Energy development has always depended on choices – by consumers, producers, governments and society. This has brought about an energy system based on those sources seen as most satisfactory in terms of cost, quality, reliability, security, convenience and social impact. In thinking about the future of that system, we need to examine the key drivers of fundamental change – resource constraints, technology development, and changing social and political priorities.

Speaker Y: There are a number of key questions:

- When will oil and gas resources cease to meet rising energy demand, and what will replace oil in transport?

- Which technology will win the race to improve environmental standards of vehicles?
- How will demand for distributed power shape the energy system? Who will drive the market growth and cost reduction of renewable energy sources, and how will energy storage for intermittent renewables like solar and wind be solved?
- How will emerging economies balance rapidly growing energy needs with rising import dependence and environmental effects?
- Where will social and personal priorities lie and how will these affect energy choices?

Speaker X: In particular, we have to address the overarching question: What energy needs, choices and possibilities will shape a global energy system which halts the rise in human-induced carbon dioxide emissions within the next 50 years without jeopardising economic development?

Speaker Y: Advances in biotechnology, materials technology such as carbon nano-fibres, and information and communications technology will support development of bio-fuels, fuel cells, new energy carriers such as hydrogen, micro-power networks, and new generations of solar technologies.

(Adapted from www.bbcnews.com)

Read the text and answer the questions.

- a. How do you think energy systems can evolve during the future?
- b. How has the present energy system evolved? What is it based on?
- c. List at least two questions which arise in this discussion of energy needs.
- d. What kind of energy needs, choices and possibilities will shape a global energy system for the future which will halt the rise in carbon dioxide emissions?

Language development

* Look at these examples of words with the prefixes **micro-** and **under-**

► A **micro-power** network is one that carries very little power.

► A country which is not very highly developed is an **underdeveloped** country.

a

Now complete these sentences with words which have the prefix **micro-** or **under-**

- i. A processor which is made on a very small scale is a
- ii. A living creature which is too small to be seen is
- iii. A person who does not have enough nourishment is
- iv. An employed person who does not have enough work is
- v. Engineering on a very small scale is called.....
- vi. When you think someone's abilities are less than they actually are, you have them.

b

Read the words below. Note the stressed syllables.

<u>surfaces</u>	<u>exploit</u>	oil-rich	<u>feasible</u>
<u>conservation</u>	<u>feedstock</u>	crude oil	<u>columns</u>
<u>lubrication</u>	<u>consumption</u>		

Fill in the blanks with the appropriate word.

1. Many Arab countries are
2. Petrol leaves the ground in the form of
3. Friction is reduced by
4. Bitumen or tar is used for road

5. Figures in log tables are arranged in horizontal rows and vertical
6. Our of food must be limited to suit our digestive system.
7. of energy will reduce demands for energy.
8. Some selfish employers try to their employees.
9. Before undertaking an adventurous project, one must consider if it is
10. Material which is fed into an industrial process is called

c

Strike out the word that does not belong to the group. Say why it is different from the other words.

For example: **doctor, nurse, hospital, x-ray, nomad**

Answer: All the other words are about health, but **nomad** is not.

- i. economy, per capita income, wealth, treasure
- ii. industrial, rates of production, prices, dramatic, consumption
- iii. schools, deserts, universities, academics, colleges
- iv. swords, standstill, muskets, arms, weapons
- v. business, ransom, commodity, scarce, costly
- vi. tents, palaces, homes, camels

If you are unsure of any word, ask your teacher.



Reading

Solar Energy

a

Before you read the text, answer these questions.

- i. Name some of the sources of energy humankind has been using over the years.

- ii. Can you think of the benefits of solar technology?
- iii. Where do you think solar energy is derived from, and do you think this will last?

Part 1

SOLAR ENERGY



Solar technologies use the sun's energy and light to provide heat, light, hot water, electricity, and even cooling, for homes, businesses, and industry.

Photovoltaic solar cells, which directly convert sunlight into electricity, are made of semiconducting materials. The simplest cells power watches and calculators and the like, while more complex systems can light houses and provide power to the electric grid.



Buildings designed for passive solar and daylighting incorporate design features such as large south-facing windows and building materials that absorb and slowly release the sun's heat. No mechanical

means are employed in passive solar heating. Incorporating passive solar designs can reduce heating bills as much as 50 per cent. Passive solar designs can also include natural ventilation for cooling.

Concentrating solar power technologies use reflective materials such as mirrors to concentrate the sun's energy. This concentrated heat energy is then converted into electricity.

Solar hot water heaters use the sun to heat either water or a heat-transfer fluid in collectors. A typical system will reduce the need for conventional water heating by about two-thirds. High-temperature solar water heaters can provide energy-efficient hot water and hot water heat for large commercial and industrial facilities.

The availability or access to unobstructed sunlight for use both in passive solar designs and active systems is protected by zoning laws and ordinances in many communities.

Consumer demand for clean renewable energy and the deregulation of the utilities industry have spurred growth in green power, solar, wind, geothermal steam, biomass, and small-scale hydroelectric sources of power. Small commercial solar power plants have begun serving some energy markets.

Read the report, and say whether the following statements are true or false.

- i. Solar energy is derived from the light and heat of the sun.
- ii. Buildings can be designed to absorb and release the sun's heat as required.
- iii. There are levels of complexity in the intensity of light of photovoltaic solar cells.
- iv. Concentrated heat energy derived from the sun can be converted into electrical energy.
- v. Solar water heaters can use the heat of the sun to heat water or even large commercial establishments.

- vi. Some laws and governances do govern access to and availability of sunlight.
- vii. Growth in green power, solar power, wind power etc. is the result of consumer demands.

Language Focus

Correct the errors in the following passage.

Concentrated heat energy converts to electricity. Solar water heaters use sun to heat water or a heat-transfer fluid. A typical system reduces need for conventional water heating into two-thirds. High temperature heaters can provides hot water and heat in commercial and industrial facilities. The access of unobstructed sunlight in active and passive solar designs protected by zoning laws. Consumer's demand has spurred growth to green power, solar, wind, steam etc. powers. Small commercial solar power plants have begun serve energy markets.

- i. If that strikes oil, then production wells can be drilled.
- ii. They carry out surveys from the ground and from the air using a variety of instruments, and they bore into the rocks to take samples.
- iii. When petroleum engineers search for oil, they look for certain types of rock layers, or strata, which they know from past experience can trap oil.
- iv. If it indicates that oil may be present, a test well is drilled.
- v. Oil is found underground trapped in the layers of rock.
- vi. When all the information is collected and analysed, a picture of the underground strata is obtained.
- vii. They also set off explosions in the ground and record the waves reflected from the underground rock layers.
- viii. This is called seismic surveying.

Part 2

Language focus

Prospecting for oil

a

The sentences in task b below are not in the right sequence. Read each sentence and underline the reference words (it, they, etc.). Then do task b.

b

Sequence these sentences to make a paragraph about prospecting for oil. The words that you underlined in task a should help.

Discussion

A world without oil

What would the world be like if our supplies of oil were to run out (or become unobtainable)?

a

Make a list of all the things you can think of which come from crude oil, not forgetting the products of petrochemical industries.

b

Classify the uses of your listed items using general headings such as domestic, industrial, transportation, chemical.

- v. His clothes have become wetter than they were before because of his walk in the rain.
- vi. The dependence on alternative power sources is heavier in developing countries than in developed countries.

Writing

A world without oil

Imagine it is now 50 years in the future. There is very little oil left. Write a paragraph telling young people how life was better, because of oil, in the twentieth century.

Begin: In my day, oil was plentiful, we could...
but these days we cannot...

F o l l o w - u p

Language development

Comparison is expressed by adding the endings **-er** and **-est** to adjectives. With certain adjectives we use **more** and **most** instead of **-er** and **-est**. For some adjectives, completely different words are used. For example **bad**, **worse**.

Study the sentences given below. Underline the comparative adjectives. Find out how these adjectives are modified in English to denote comparison.

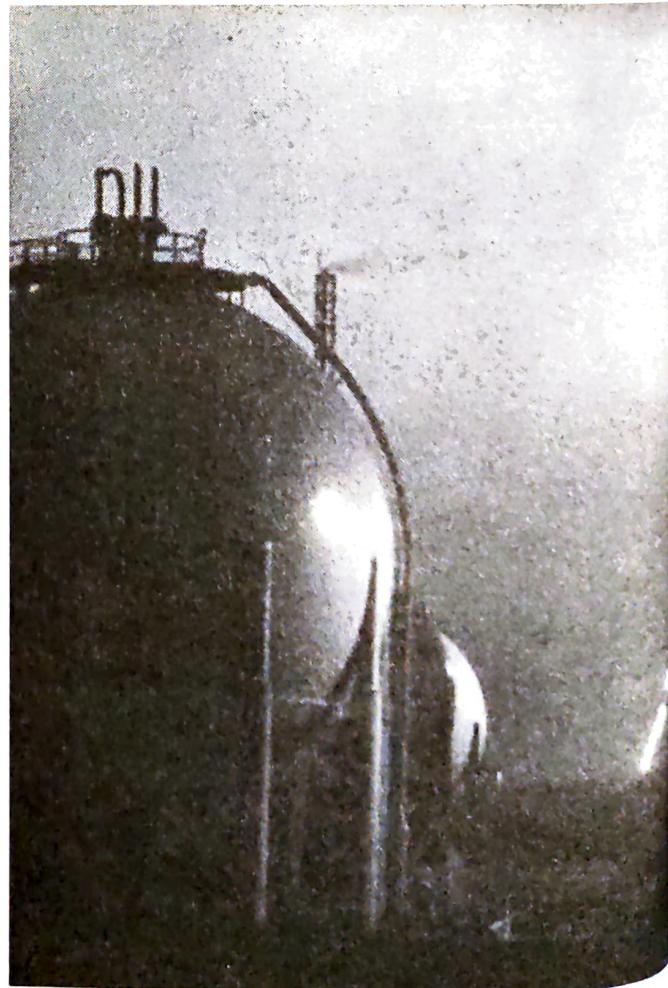
- i. Saudi Arabia was more reluctant to increase oil production than many other countries.
- ii. Venezuela is closer to the equator than Bolivia.
- iii. Dealers feel that the sale of four-wheelers will definitely be better in the future than it is now.
- iv. 24-carat gold is purer than 22-carat gold.

Look at the following comparative adjectives and put them into groups according to how they are formed.

larger	easier	wealthier
more important	more powerful	worse
more interested	cheaper	heavier
higher	better	
more traditional	bigger	wetter

Write the comparative forms of the following adjectives.

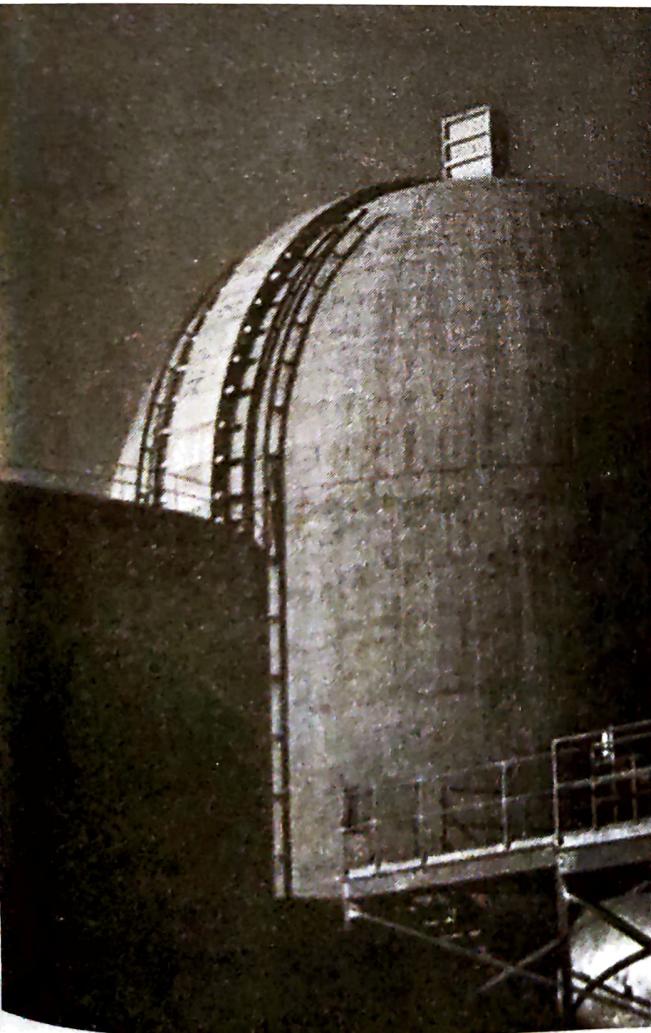
dry	sturdy	valuable	simple
greedy	feasible	good	beautiful
professional	reliable		



2

NUCLEAR POWER

Preparation



Oral practice

Work in pairs.

a

What do you understand by the term 'nuclear energy'?

b

What are the uses of nuclear energy?

c

Are there any dangers involved in the use of nuclear energy?

d

Do you know of any recent accidents involving nuclear energy?

Language development

a

Look at the words in column A in task b on the next page and make sure you can pronounce them properly. Then do task b.

b

Match the word in column A, with its meaning in column B.

A	B
nucleus	division of the atom
uranium	getting rid of
fission	pollution
disposal	central part of the atom
core	producer
coolant	metallic element
breeder	giving out rays
radiation	danger
hazard	cooling fluid
contamination	the innermost part

- v. An accident in a nuclear power station can lead to a great
- vi. Causing destruction through atom bombs is a clear example of of scientific knowledge.
- vii. Prospecting for oil is in many ways than extracting it.
- viii. Uranium and plutonium are nuclear fuels.
- ix. When oil becomes many countries consider using alternative energy sources for economic reasons.

**c**

Guess the meanings of these words and phrases (if you do not know them already).

derived from	consumption	generated by
depleted	disaster	more difficult
abuse	expensive	radioactive

Now use the words/phrases to complete the sentences below.

- i. In hydel units, electricity is heating water.
- ii. Vast quantities of energy can be a very small quantity of nuclear fuel.
- iii. The existing coal reserves will fast become if we continue to use such a large amount of coal.
- iv. Our present of oil and gas exceeds the present production levels.

d

Underline all the phrases in the text which are used to make recommendations.

For example, It is necessary to A coolant channel replacement machine (CCRM) should be developed to carry out large scale replacement of pressure tubes in Pressurised Heavy Water Reactors Servomanipulators. Images have to be incorporated in the system. Since many challenges are foreseen in the area, the engineers ought to prepare themselves for the task. It is necessary to set up fast breeder reactors to multiply fissile material inventory.

part I

Reading

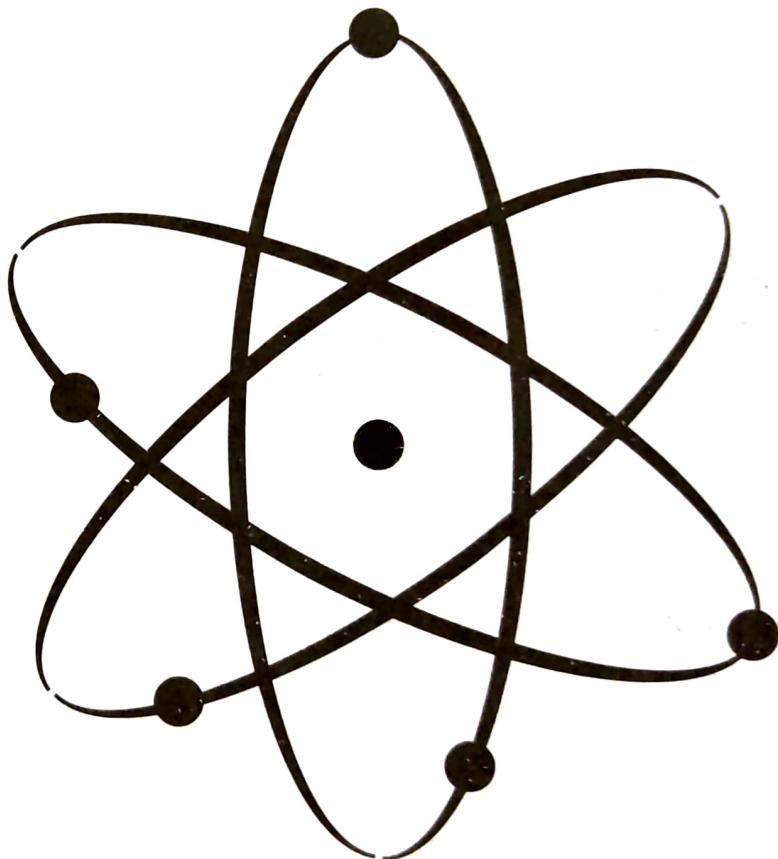
US and India seal Nuclear Accord

a

- i. What does energy mean to people in India?
Think of three people from different walks of life. How would they respond to this question?
- ii. What do you know about nuclear power?
Why do you think it is called this?
What do you know about nuclear fuels?
- iii. The reading text on the next page is about the accord signed between India and the U.S. for sharing of nuclear power. What do you think the impact of this would be? Make a list.

b

- i. Reading the first sentence of a paragraph can often give you an idea of what the whole paragraph is about. Try out this technique with the paragraphs on the next page.
Make a note of what you think each paragraph is about.
- ii. Which part of the text gives you India's 3-stage nuclear power programme? Make a list of these stages.



c

Work in pairs. Read each paragraph on the next page. Think of sub-headings that you can insert in the text in consultation with your partner. Be ready to report back when the teacher asks you to do so.

US AND INDIA SEAL NUCLEAR ACCORD



A

The US and India have finalised a controversial nuclear deal after talks in Delhi between President George W Bush and Indian Prime Minister Manmohan Singh. Energy-hungry India will get access to US civil nuclear technology and open its nuclear facilities to inspection.

Mr Bush, on his first visit to India, called the deal 'historic'. But he said it might be hard to get it through the US Congress, which must ratify it. India has not signed the Nuclear Non-Proliferation Treaty (NPT).

B

The BBC's Sanjoy Majumder in Delhi says the nuclear deal will end years of international isolation for India over its nuclear policy. But critics say it sends the wrong message to countries like Iran, whose nuclear ambitions Washington opposes. Communist parties and Muslim groups are opposed to the visit and are leading protests across India, but Mr Bush is being welcomed by many other Indians.

C

Speaking at a news conference after the talks, President Bush

- said that trade between the two countries was growing;
- promised to share information on terrorism and cooperate militarily;
- encouraged India and Pakistan to resolve the Kashmir dispute;
- joined India in criticising the human rights situation in Burma.

D

NUCLEAR POWER IN INDIA

India has 14 reactors in commercial operation and nine under construction. Nuclear power supplies about 3% of India's electricity. By 2050, nuclear power is expected to provide 25% of the country's electricity. India has limited coal and uranium reserves. Its huge thorium reserves - about 25% of the world's total - are expected to fuel its nuclear power programme long-term.

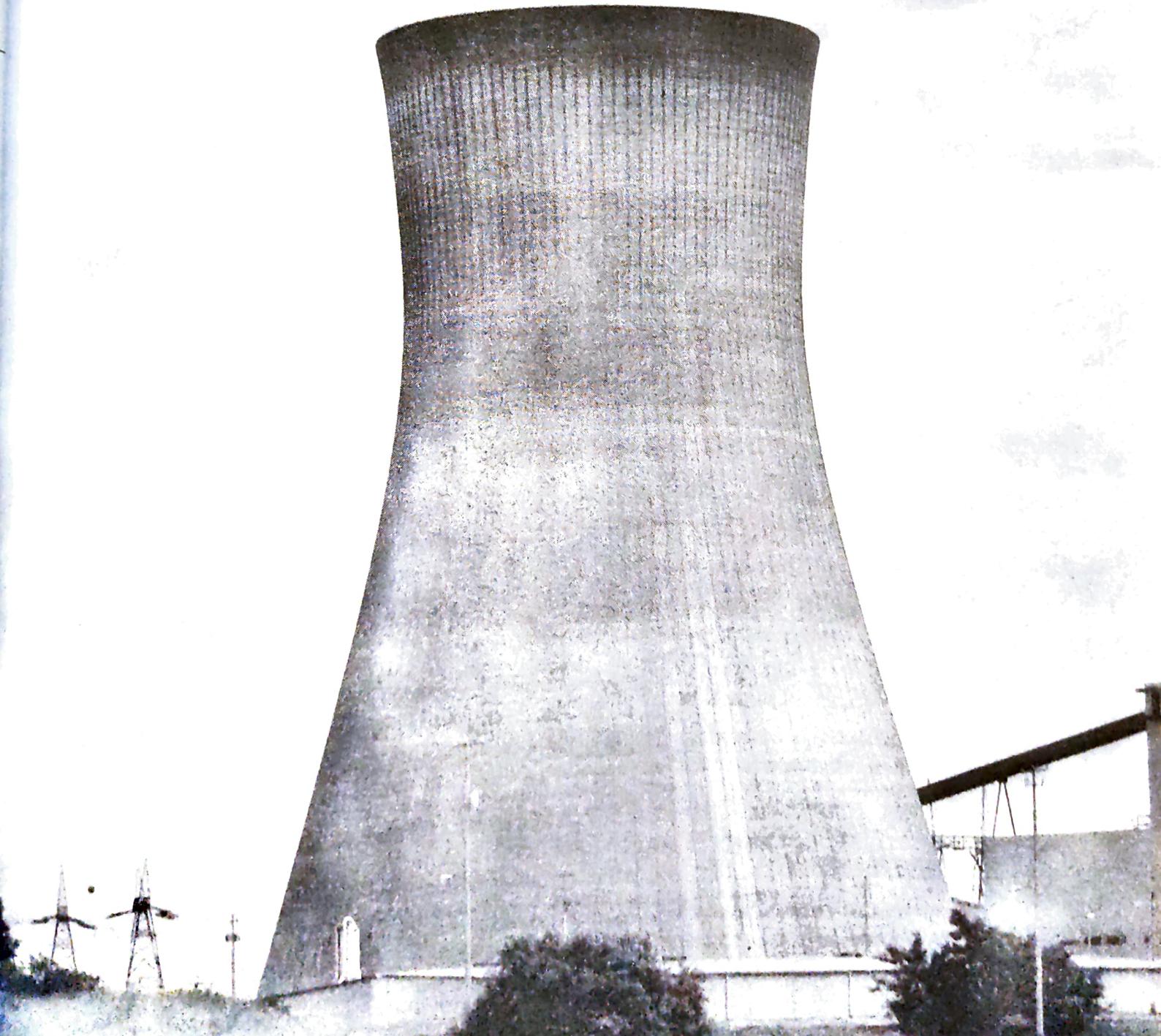
E

Dr Manmohan Singh said India had finalised a plan to separate its military and civilian nuclear facilities, a move contingent on the deal going through. 'We have made history today,' he said, praising Mr Bush's personal efforts to secure the accord. Under the agreement, India will classify 14 of its 22 nuclear facilities as being for civilian use, and thus open to inspection. France, which signed a similar deal of its own with India last month, said the accord would help fight climate change and non-proliferation efforts..

F

Those opposed to the deal, in the US Congress and elsewhere, disagree. Many supporters of the NPT believe the deal ignores India's nuclear weapons programme. In India, too, critics have alleged that the country's tradition of non-alignment is being eroded as it forges closer ties with the US. India's traditional rival, Pakistan, indicated that it wanted a similar agreement.

'Pakistan believes that we also have a claim, an expectation for international cooperation under safeguards for nuclear power generation,' Pakistan's foreign ministry spokeswoman Tasnim Aslam said.



G

WHAT ARE INDIA'S AVAILABLE ENERGY RESOURCES?

India's available energy resources are shown in the following table:

Identified energy reserves

coal	186 billion tonnes
lignite	5,060 million tonnes
crude oil	728 million tonnes
natural gas	686 billion Cu-m
uranium	78,000 tonnes
thorium	3,63,000 tonnes
hydro	84,000 MW at 60 % PLF
renewables biomass	6000 MWe
wind, solar etc.	20,000 MWe

H

WHAT IS INDIA'S THREE-STAGE NUCLEAR POWER PROGRAMME?

In view of the limited fossil fuel availability with the country, the relevance of nuclear power in meeting the short and long term needs of our energy was recognised right at the initial stage. From the very beginning, as a long term strategy, the Nuclear Power Programme formulated by Dr Homi Bhabha embarked on the three stage nuclear power programme, linking the fuel cycle of Pressurised Heavy Water Reactor (PHWR) and Fast Breeder Reactor (FBR) for judicious utilisation of our limited reserves of uranium and vast thorium reserves. The emphasis of the programme was self-reliance and thorium utilisation as a long term objective. The PHWR was chosen due to extensive research and development facilities covering diverse areas for supporting technology absorption.

The three-stage of our nuclear power programme are:

Stage 1: envisages construction of natural uranium, heavy water moderated and cooled Pressurised

Heavy Water Reactors (PHWRs). Spent fuel from these reactors is reprocessed to obtain plutonium.

Stage 2: envisages construction of Fast Breeder Reactors (FBRs) fuelled by plutonium produced in stage 1. These reactors would also breed U-233 from thorium.

Stage 3: would comprise power reactors using U-233 / thorium as fuel.

Source: BBC News

Comprehension check

Look at the text 'US and India sign nuclear accord' on pages 44-46 and say whether these statements are true or false. Correct the false statements.

- President Bush said that it might not be difficult to get it through the US Congress.
- This does not mean that India will get access to US nuclear technology.
- Countries such as Iran might be pleased with this nuclear accord.
- There is abundant fossil fuel availability in India.
- The three-stage nuclear power programme links the fuel cycle of PHWR and FBR for judicious use of our limited reserves.
- Critics allege that the deal erodes India's tradition of non-alignment.

Listening

Two kinds of nuclear reactor

You are going to listen to a short talk about two types of nuclear reactor. Use the format below to help you write the notes.

	1	2
types of reactor		

reason for name	
coolant system	
relative merits	
other information	

Using the notes you have made, decide which type of nuclear reactor you would recommend, and make out a case for it. Then defend your choice to your partner. (For a better discussion, don't choose the same reactor as your partner!)

Part 2

Reading

Dangers and disasters

a

Make brief notes to answer these questions.

- i. What dangers do you think can arise from the use of nuclear power?
- ii. Can you think of any possible abuse of nuclear power?
- iii. What instances can you recall of a disaster involving nuclear power?
- iv. What safety measures do you think should be adopted while dealing with nuclear power?

b

Now quickly skim the text below entitled 'Dangers and Disasters' and suggest a suitable heading for each paragraph.

DANGERS AND DISASTERS



A

Nuclear fuels such as uranium and plutonium are radioactive. They give out dangerous and very penetrative radiation. During fission even more radiation is produced. This radiation is harmful even in small quantities. It attacks living tissues and it can alter the genes in body cells. Such mutation can affect later generations. In large quantities its effect is lethal.

B

Nuclear reactors produce wastes which remain dangerously radioactive for hundreds or perhaps thousands of years. The disposal of these wastes is a serious problem. At present, they are often stored in underground tanks or sealed in containers and dropped into deep ocean trenches. Neither method is very satisfactory. The threat of environmental pollution is always there.

C

Nuclear plants need to be suitably located away from densely populated areas. Adequate waste disposal facilities must be available. The reactor ought to be surrounded by concrete and steel walls thick enough to prevent any escape of radiation. The working of the reactor should be slowed down by inserting control rods, also known as neutron absorbing rods, into the core. It is necessary that the reactor has emergency systems to cope with any unexpected failure of the fuel elements of the cooling system. Workers at the plants must protect themselves against possible contamination by using gloves, overshoes, respirators etc. Radiation measuring instruments have to be used to monitor radiation levels in and around the plants. It should be ensured that all releases into air and water are kept well below permissible levels.

C

Does the text answer all the questions in a above?

Language focus

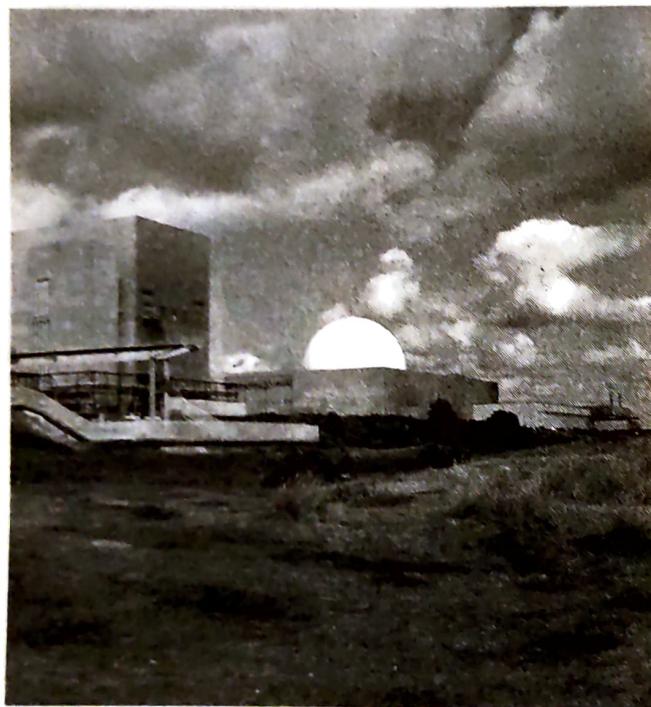
Safety in nuclear plants

a

Underline all the phrases in the third paragraph of the text above which express recommendations (e.g. It should be ensured that).

b

Work in pairs. Using the expressions you have just underlined, ask and answer questions about safety measures in nuclear power plants.



Reading

Leaks at India's Nuclear Power Plants

The text below describes the inherent dangers in India's nuclear power reactors in comparison with International standards.

- Skim the text for gist. (1 minute)
- Read the text quickly, noting which sections discuss the status of India's nuclear power plants.
- Make notes about these factors under the headings 'Dangers', 'Standards' and 'Precautions to be taken'.

LEAKS AT INDIA'S NUCLEAR-POWER PLANTS: CAUSE FOR CONCERN?



Even the country's safest reactors do not meet international standards, according to its atomic regulations agency.

Kakrapara Atomic Power Station (KAPS), in the western city of Surat, is India's well-groomed nuclear workhorse. When it comes to controlling radiation leakage, KAPS is 'our best station,' says S.P. Sukhatme, chairman of India's Atomic Energy Regulatory Board (AERB).

That, it turns out, is bad news. KAPS may be India's prized nuclear plant, but radiation emitted from its reactors is three times as much as the international norm, says Mr Sukhatme.

It is a shocking admission that puts the rest of the country's nuclear-power plants in grave perspective. 'The main implication is that other nuclear-power plants are much worse than even Kakrapar,' says Suren Gadekar, considered to be India's top anti-nuclear activist.

There has always been this worry about the possibility of two nuclear-weapons rivals, India and Pakistan, approaching the brink of war. That problem apparently on hold, India's nuclear scientists say the country could still face an equally devastating nuclear catastrophe without a shot being fired.

This time, the threat is not Pakistan or terrorists, but India's power plants themselves. Some scientists say that the plants are so poorly built and maintained and so a Chernobyl-style disaster may be just a matter of time.

'The fact that India's nuclear regulator acknowledges that reactors in India are not operated to the standards of reactors in the US and

Europe is not much of a surprise,' says Christopher Sherry, research director of the Safe Energy Communication Council in Washington. But it is very disturbing.' Today, India has 14 nuclear power reactors including two at KAPS. Most are modelled after a design first built in Pennsylvania in 1957. However only three of those nuclear reactors fall under International Atomic Energy Agency (IAEA) standards. The rest, which were built with local technology, are accountable only to national standards set by the AERB.

When the reactor in the state of Rajasthan that first put India on the nuclear world map developed a series of defects, starting with 'turbine-blade failures', the AERB ordered its closure. While the government releases no information about leaks or accidents at its nuclear power plants, Dhirendra Sharma, a scientist who has written extensively on India's atomic-power projects, has compiled figures based on his own reporting. 'An estimated 300 incidents of a serious nature have occurred, causing radiation leaks and physical damage to workers,' he says. 'These have so far remained official secrets.'

The chairman of India's Atomic Energy Commission, Anil Kakodkar, has repeatedly asserted that his group is doing what it can to ensure that the country's power plants are safe. Still, leaks continue to raise serious questions about safety.

Part of the problem, says a former manufacturer of nuclear reactor components, is that well-connected manufacturers are able to cut deals with politicians in India's Department of Energy, often selling defective parts, which are then used to build reactors.

According to Dr Kakodkar, India should not be held accountable to international standards until the international community helps make such technology available to developing countries. 'Safety and technology cannot be divorced,' he says. (Source: V. K. Shashikumar, Special to *The Christian Science Monitor*, New Delhi)

Learner Awareness

What you have been doing is a form of study reading which is useful when you have a clear purpose for your reading.

Writing

Leaks at India's Nuclear Power Plants

Using the notes made in 'c' above, write a paragraph about the need to bring India's nuclear-power plants to required standards. Then write a list of precautions inferred from this.

F o l l o w - u p

Writing skills development

a

Use the notes you made from the listening exercise on page 46-7 to complete this paragraph comparing the two types of nuclear reactor.

One of the main differences between the pressurised heavy water reactor and the fast breeder reactor is that the PHWR uses water as a coolant while the fast breeder reactor uses liquid sodium metal for this purpose.

Also..... smaller.....

Therefore..... more compact.....

..... higher power density

..... lower capital costs

But,..... more efficient

..... twice as much

b

Write a short paragraph of five sentences expressing your views on the nuclear tests conducted at Pokhran on 11 May 1998.

3



ALTERNATIVE SOURCES



* Language development

Preparation

a

Choose suitable words from the box to fill in the gaps in this passage. Use each word only once. The underlined indicates stress.

global causing ignite plague
spontaneously contributing particularly douse
geological discarding

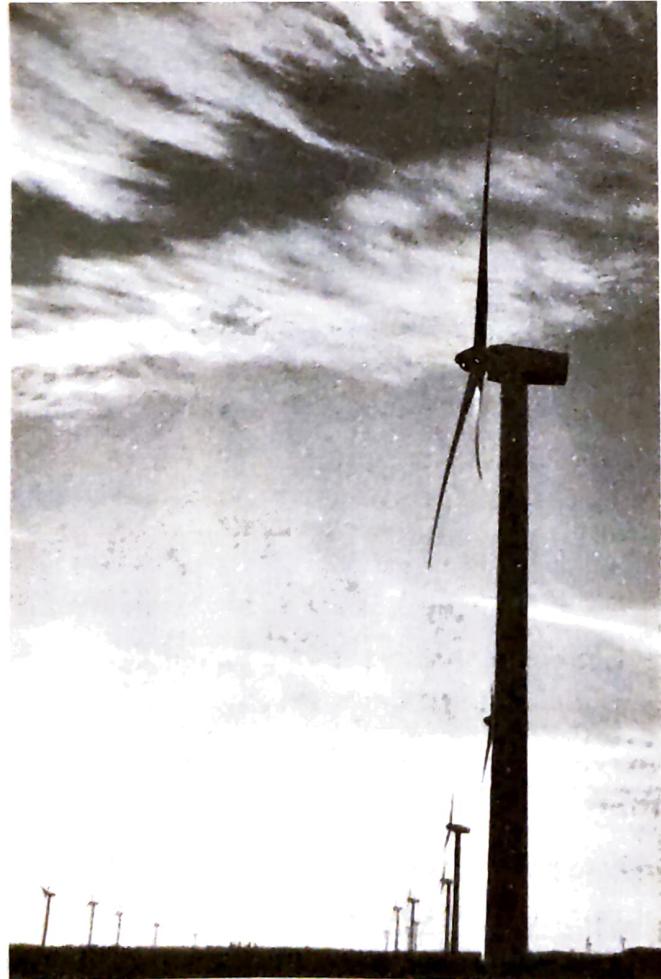
Scientists warn that wild coal fires are a catastrophe, burning hundreds of millions of tonnes of coal every year and to climate change and damaging human health.

These fires can rage both above and below ground and may contribute to more than three per cent of the world's annual carbon dioxide emissions, which are thought to global warming.

Coal fires occur wherever there is coal, but major fires blaze in Indonesia, China, India and the US.

Underground fires can be dangerous as they can burn for decades and forest fires in times of drought. Surface fires tend to be eventually by rains, but underground fires burn until they exhaust the coal or hit the water table, he said.

Indonesia has been with coal fires for two decades, ever since a drought induced by the weather phenomenon El Niño in 1982.



Although coal seam fires have occurred far back into history, they are much more common now. Mining activities like welding, using explosives, or miners simply cigarette butts can ignite them. It's almost always someone's hand that does it. Currently 63 fires are being monitored in the US.

b

- i. For each word in column A, find a word in column B with the opposite meaning.

A	B
<u>abundant</u>	<u>simple</u>
<u>artificial</u>	<u>desalination</u>
<u>former</u>	<u>natural</u>
<u>sophisticated</u>	<u>latter</u>
<u>salination</u>	<u>limited</u>

Learn the correct pronunciation of the words in A and B with your teacher's help.

c

Now complete these sentences with the words in B above.

- Since the reserves of oil and gas are we have to look for other energy sources.
- The developed countries should help the developing countries so that the can meet the basic necessities of their people.
- The gobar gas plant, or biogas generator, is a apparatus when compared to a nuclear reactor, which is far more
- In spite of the higher cost involved in the process of, it is used on a large scale in many oil-producing countries because there is an acute shortage of water.

★ Oral practice

Read the text in a again. Now tick (✓) those items in the list below that you consider to be the disadvantages of some coal fires.

- ✓ causes atmospheric pollution
- ✓ causes global warming
- ✓ renewable
- ✓ less expensive
- ✓ involves high technology
- ✓ can be quickly ignited

Compare your list with a partner's.

Now say which of the advantages of using coal as an alternative source of energy make it appropriate for India.

Be ready to say what you think when your teacher asks you.

★ Language development

a

Make nouns of the following verbs by adding the suffix -tion.

For example, **salinate** → **salination**.

construct	pollute	conserve	destroy
compose	electrify	irrigate	ferment

b

- ▼ Make as many words as you can from the following by adding different endings.
- ▼ Make sure that you know the meanings of all the words.
- ▼ Be ready to put them in sentences to show their meanings when your teacher asks you.

e.g. science → scientific, scientist

- i. photo →
- ii. maintain →
- iii. alternate →
- iv. renew →
- v. inferior →

Part 1

Language focus

Alternative energy sources

a

Complete the text below by selecting the most appropriate word or phrase from the alternatives given in the right-hand column.

The use of alternative
sources of energy is attractive
because of the high price
and
availability of oil, the pollution
that is associated with the
burning of fossil fuels, the
tremendous expense and
..... of nuclear
power, and a variety of other
reasons. In
countries, their initial
development came at a time
of relatively plentiful oil
supplies at
cost. This resulted in their
being more
this single source of
energy than is true in the
..... countries.

artificial/natural

abundant/limited

dangers/uses

developing/
developed

lower/higher

independent of/
reliant on

developing /
developed

b

Check your answers with a partner before your teacher checks with the class.

Discussion

Drawbacks of electricity

a

Work in pairs.

List the problems involved in producing and using electricity in India.

b

Read each of the following statements and decide if you think they are true or false. State your reasons.

- i. Alternative natural sources of energy are so cheap, there is no need to use them carefully.
- ii. There are only three renewable sources of energy.
- iii. Energy conservation is cheaper than extra energy production.
- iv. Alternative sources of energy involve little or no environmental pollution or destruction.
- v. These alternative energy technologies are relatively simple in construction and maintenance.
- vi. Alternative energy technologies have a stigma of technical inferiority since they are applicable only to small scale industries.
- vii. The power needs of larger industries can be met by alternative energy units.
- viii. Energy from natural sources is not sufficient to meet the fuel needs of the rural masses in India.

Reading

Two alternative energy devices

a

Below are descriptions of two alternative energy devices. One is used in a developing country, the

Philippines, and the other was in common use in a developed country, the United States. After reading the passages you will be asked to choose the device you feel would be more suitable for use in India.

PEDAL POWER

Pedalling is probably the most efficient use of the muscles of the human body. Pedal power, using either a bicycle-like pedal arrangement or a treadle mechanism, can be used to power a range of agricultural equipment, water pumps, grinders and electric generators.

At the International Rice Research Institute in the Philippines, engineers have developed a small, lightweight, inexpensive foot-powered pump that will lift large quantities of water several feet, using only moderate amounts of human power. The operator simply stands on two footrests at either end of the pump and rocks back and forth. This effect compresses a diaphragm which forces water from the outlet valve. By operating the pump in a rhythmic manner, a continuous flow of water is pumped.

THE CASE FOR WIND POWER

For human development to continue, we will ultimately need to find sources of renewable energy. It is difficult to imagine this, but even if we find several hundred or even thousand years of coal and natural gas supplies, what will humans do for the next 250,000 years or so after they are depleted?

There's a lot of underlying popular support for wind energy and the other renewables in the United States. But there's also a lot of apathy as well. We are gulping down the few remaining years of cheap natural gas and Mid East oil. As we do this, the inertia of global warming is inexorably building.



What drives the continued development of mechanical devices like wind turbines in the face of this widespread lack of support? In the case of wind turbine technology, part of the reason for persistence of this vision is how accessible wind turbines are to the understanding. They are personal in a way that almost no other form of power generation is.

Wind energy conversion is a fascinating field because its past has been so checkered and its exact future is so uncertain. Unlike the aerospace industry, the computer industry, and almost any other successful industry you can name, wind energy -- the leading mechanically-based renewable energy for much of man's history-- it has been around for thousands of years.

It's a technology that has been reinvented numerous times. And so, we are left with the promise that there will be success with wind power because of this.

(Source: <http://telosnet.com/wind/The Case for Wind Power>; © 2002 Darrell Dodge and TelosNet Web Development)

b

Complete this chart with information from the texts you have just read.

	pedal power	windmill
resources needed		
machinery needed		
possible uses		

Writing

A device for rural India

Consider both pedal and wind power in the context of rural India. Fill in the chart below to help you compare their relative merits.

in the rural Indian context	pedal power	wind power
necessary resources available?		
necessary machinery available?		
machinery sufficiently familiar?		
local construction possible?		
maintenance simple enough?		
uses required?		

Now use the chart you have just completed to write a paragraph explaining which of these devices would be more suitable for use in rural India. Plan your paragraph with the help of the chart.

Discussion

Energy for cooking

In pairs, decide what energy source might be used for cooking in the following places:

- | | |
|-----------------------|--------------------------|
| a five-star hotel | a houseboat in Kashmir |
| a village hotel | an open-air tea shop |
| a mountain region | an apartment in New York |
| an industrial canteen | a fast-food place |

Reading

Alternative sources of energy

a

Take a quick glance (1 minute only) at the texts on pages 54-5, and then decide whether they come from

- an advertisement
- a government handbook, or
- a magazine.

b

Here are six titles. Match each one with the relevant text on the next page. After completing this task, check your answers with a partner.

- Wave Power from the West
- Biogas Plants
- Seaweed Power
- Iceland's Economy
- Offshore Wind
- Solar-powered Car Sets New World Record

A

A team of Canadian students from Ontario, has set a new world record for the longest distance travelled in a solar-powered vehicle. Over 30 days, driving at average speeds of 80 kmph, the sleek, aerodynamic car, Radiance, travelled 7,044 kilometres from Halifax, Nova Scotia, to Vancouver, British Columbia.

The Sun Trek 2000 expedition hoped to demonstrate the potential of renewable energy to communities along their route. During the month-long trip Radiance used the equivalent of just £4 worth of electricity compared with over £600 in diesel fuel for a support vehicle.

According to the project's designers, the vehicle's solar panels worked well, powering the electric motor and storing excess energy in batteries for cloudy days.

B

Iceland is making plans to become the world's first hydrogen-powered economy. With backing from the Icelandic government, a consortium is using Iceland as the testing ground for a new generation of hydrogen-powered cars and buses. At present 70 per cent of the primary energy supply and 99.9 per cent of the country's electricity is produced by geothermal energy and hydropower. Iceland, however, consumes more oil per capita than any other country in the world, and the next challenge is to convert the transportation economy to renewable energy. By 2002 the country's first fuel cells will run three Reykjavik buses at a cost of \$1.25 million each, with plans to eventually power the city's 100 buses by hydrogen fuel-cell technology.

Iceland currently produces 2,000 tons of hydrogen annually, primarily to produce ammonia for making fertiliser. Between 80,000 to 90,000 tons would be needed to power the country's entire transportation sector and fishing fleets. "We believe that we can eliminate most of our dependence on oil by 2030," Hjalmar Arnason, chairman of the Icelandic government's committee for alternative fuel is reported as saying. Reducing its annual oil bill to almost zero would have a significant impact on the Icelandic economy, and could transform the already wealthy Icelanders into hydrogen sheiks of the future.

C

Two of the world's most powerful wind turbines are to be raised off the UK coast by the consortium Blyth Offshore Wind Limited. Each turbine is capable of generating two megawatts of electricity and in total will provide enough electricity to power 3,000 households annually.

The turbines will be the largest ever to be erected offshore and will also be the first to be placed in such a demanding position, subject to the full forces of the North Sea. The twin turbines are due to be installed a kilometre or so from the coast of Northumberland in the summer, and will start generating electricity in August. The turbines will be installed at an average depth of eight metres by the marine division of AMEC Capital Projects and Seacore.

The UK is one of the windiest countries in Europe, with the offshore resource theoretically sufficient to supply the UK's current electricity needs three times over.

D

Considering that 680 million cars and lorries now cram our roads worldwide, the need for alternative energy sources is greater than ever before. Biomass fuel is a source of energy derived from living organisms, commonly plant residue (dried, burned or processed into solid, liquid or gaseous fuels). The global potential of biomass energy has been estimated at 100 million megawatts per year, 35 per cent of which is from marine biomass. Marine biomass can be used to produce electricity and fuels with the added advantage of being grown in the ocean, freeing valuable agricultural land. More than five million tons of seaweed is farmed in China, Japan and the Philippines for biomass every year. The ocean is the only region that has space and sufficient water for large-scale cultivation of

new primary biomass, and efforts are under way to develop marine cultivation as well as realise its limitations and constraints.

E

The biogas generator is a simple apparatus for turning animal dung into biogas and nitrogen fertiliser. Animal dung can be supplemented by organic wastes, water hyacinth, corn stalks, wild grass and aquatic weeds.

Biogas is a gas mixture containing about 60 per cent methane and 40 per cent carbondioxide. The mixing of equal parts of animal dung, water hyacinth and algae results in upto 70 per cent of methane being produced. A one-acre plot of water hyacinth would yield 1100 cu ft of gas per day or 400,000 cu ft/yr which is equivalent to 60 MW power. Biogas can be used as a fuel for domestic cooking or for running diesel engines.

F

A team of European researchers and small businesses, coordinated by the University of Plymouth, have invented a new device for harnessing the power of the waves.

The new 'Wave Energy Device' comprises a column or cylinder, five metres in diameter, which extends some 14 metres below the surface of the sea. The device is based on the principle of multiple water columns which oscillate owing to the movement of the waves. Air in the columns, under pressure from the water below, drives a turbine to generate power.

In the short term the device could supply energy to remote islands and offshore installations with a future potential to supply coastal communities.

C

Now read the passages again more carefully in order to answer the following questions. Use

the titles to help you find the relevant part of the passage for each question.

- i. List the element(s) from which each different source of energy is being derived. What do they have in common?
- ii. Why is such intensive research being carried out to discover viable alternative sources of energy?
- iii. Is there a direct link between a country's consumption of fossil fuels and its quest for alternatives?
- iv. Which of the above sources would have universal application and which would not? State the reasons for your answer.
- v. Is development a major factor in the adoption of an alternative energy source?

Role play

Renewable energy sources

Student A

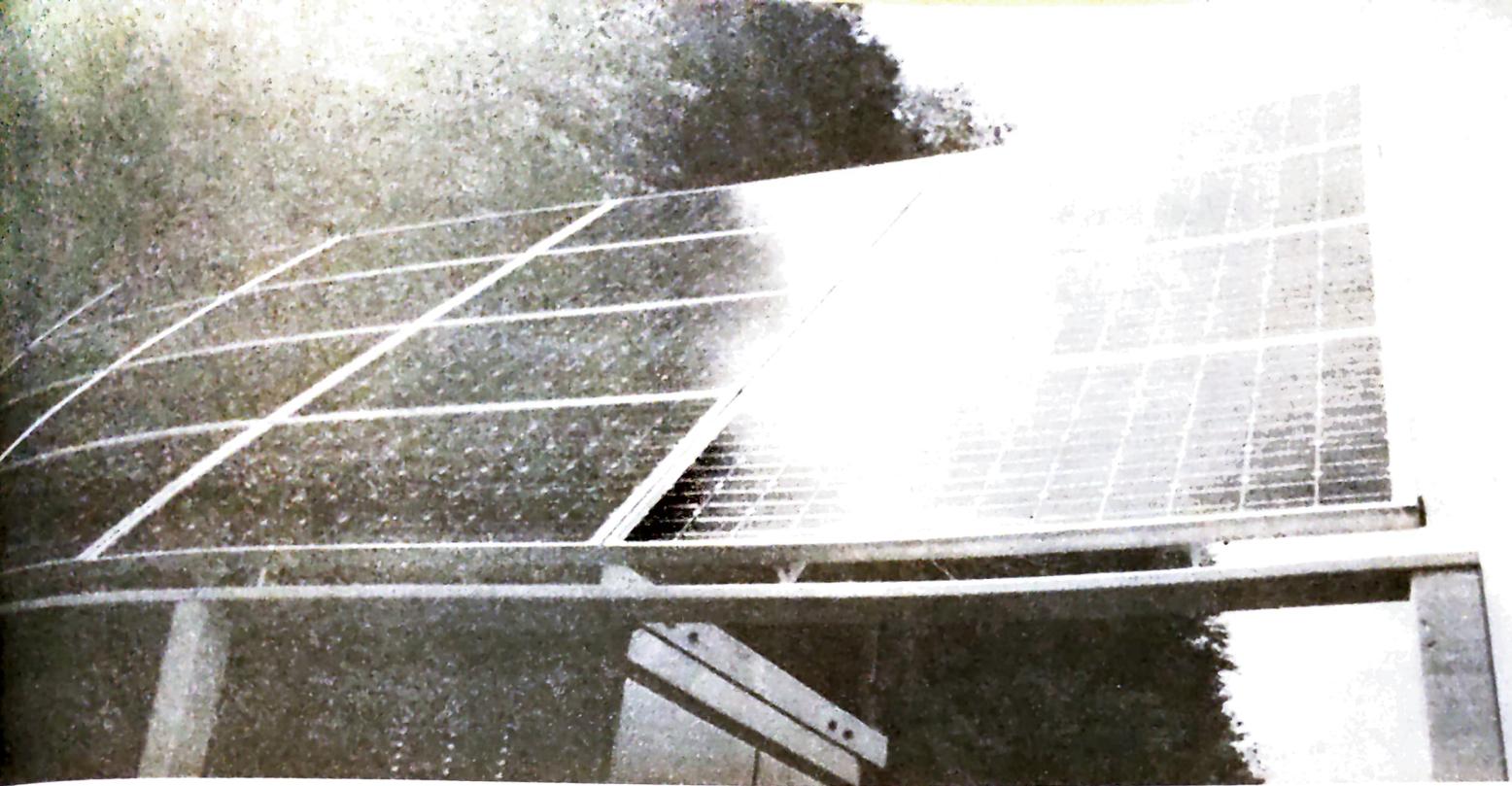
You are a journalist writing a feature article on a village that makes productive use of alternative energy sources. The people of the village are proud of their self-reliance. Prepare a list of questions to ask the sarpanch of the village as well as a few other villagers.

Student B

You are the sarpanch of a village that is becoming famous for its use of alternative sources of energy. You and some other villagers are going to be interviewed by a journalist. Prepare a list of points that will help you to answer questions. Be as imaginative as possible.

Start when you are both ready.

Try to keep the interview quite formal.



Writing

Energy for India

Choose a form of energy which you consider to be suitable for further development in India. You may look back at the work of the last three weeks for ideas. Write three short paragraphs in the way described below.

paragraph 1 : Introduce India's energy needs.

paragraph 2 : Compare your choice with other alternatives.

paragraph 3 : Summarise the advantages of your chosen form of energy.

- i. Pedal power can only be used for one type of agricultural equipment.
- ii. The foot-powered pump developed in the Philippines will lift large quantities of water.
- iii. This pump needs a great amount of human power.
- iv. It does not weigh very much but it is expensive.
- v. It is not possible to pump a continuous flow of water using this pump.

b

Now listen to your teacher and decide if the sentences are true or false.

Language check

Your teacher will dictate a passage to you about wind power. Check your spelling and punctuation carefully with reference to the text on page 53.

Oral practice

a

Before your teacher talks to you about pedal power, read these sentences.

Using the chart you prepared on page 54 ask and answer questions. Work with another student.

b

Say which of these devices would be more suitable for use in rural India. State your reasons. Try and make use of appropriate comparative adjectives.

Language check

Wind power phones

Choose words from the box and fill in the appropriate blanks in the passage.

protect	wind	energy
source	conventional	power
constant	operate	damage
environment	quietest	cheaper

One 2 One is a mobile phone company based in the United Kingdom. It is taking the lead in testing the use of turbines to power its base stations in remote parts of the country in a move to the environment.

The first mobile phone base station in the UK to use the wind as an has been erected by One 2 one at Cairnsaigh Hill in Scotland.

The 7.5-meter-high wind turbine can provide all the needed by the base station. Unlike the stations, where winter power failures may require the use of diesel generators, the wind turbine can all year round, however strong the wind. A unique blade-feathering device keeps the blades spinning at a speed no matter how strong the wind gets..

The wind turbine provides free, reliable, friendly power and also avoids caused to the health of people when electricity cables are installed.

“Under the right conditions a turbine can be considerably than mains power”, said Greg Mould, One 2 one’s health, safety

and environment adviser. “In addition, its environmental impact is about as small as it’s possible to get”.

A low rotor speed makes it one of the wind turbines in the world and a patented polypropylene blade design allows the turbine to function at full power in speeds of upto 240 kilometers (150 miles) per hour.