

This is a test of your ability to understand an academic lecture. The lecture you will hear has two parts. In the first part, you will first study the outline of the whole lecture and then the list of vocabulary that you will hear in the lecture. I will read the lecture only ONCE. Use your notepaper to take notes as you listen to the first part of the lecture. After I read the first part, I will distribute the questions for the first part. Answer the questions from 1-10 using your notes. You will have 13 minutes to answer these questions. At the end of 13 minutes, I WILL COLLECT THE QUESTION SHEETS AND NOTE PAPER.

Then I will read the second part of the lecture. Use your notepaper to take notes as you listen to the second part of the lecture. After I finish reading the lecture, I will distribute the questions for the second part. Answer the questions from 11-20 using your notes. You will have 13 minutes to answer these questions. At the end of 13 minutes, I WILL COLLECT THE QUESTION SHEETS, VOCABULARY SHEETS, and NOTE PAPER.

Now look at the outline of the whole lecture for 1 minute and try to guess what you are going to hear about. **(1 MINUTE PAUSE) (DON'T read the outline!)**

### OUTLINE OF THE LECTURE

#### Part 1

1. Solar Energy
  - History
  - Advantages
  - Disadvantages

#### Part 2

2. Wind Energy
  - History
  - Advantages
  - Disadvantages
3. Nuclear Energy
  - Definition
  - Advantages
  - Disadvantages

First, study the list of vocabulary for the **WHOLE** lecture for 2 minutes. All of the words in this list will appear **in the order of the lecture**. Some of them will be explained in more detail in the lecture. Then, I will read out the vocabulary, so you can become more familiar with my voice and pronunciation. **Now, you have 2 minutes to look at the vocabulary on the back of this page.**

**(2-MINUTE PAUSE – Then the lecturer reads the vocabulary list out loud.)**

- emission (n)** something that goes into the air. ***For example:** The emission of carbon dioxide causes air pollution.*
- regulate (v):** to control; to balance. ***For example:** Because of the energy crisis, people have to regulate their energy consumption.*
- pollutant (n):** something that causes pollution. ***For Example:** City air is filled with pollutants.*
- maintenance (n):** keeping something in good condition. ***For example:** Maintenance of a luxury car is expensive.*
- supply (n):** the amount of something that is ready for use; a stock. ***For example:** In underdeveloped countries, food supplies are not enough.*
- unpredictable (adj):** that cannot be told beforehand. ***For example:** You never know what John will do; he is so unpredictable.*

***Terms explained in the lecture:***

photovoltaic cell  
photoelectric effect  
horizontal  
wind turbines  
wind farms  
nuclear power  
nuclear fusion  
nuclear fission  
nucleus  
nuclear waste

***Names used in the lecture:***

Socrates' Megaron House  
Charles Fritts  
Albert Einstein  
Nobel Prize  
Bell Laboratories  
Iran  
James Blyth

Now, pick up your pencils to take notes. Be ready to listen to the lecture.  
**(about 1-minute PAUSE for students to get ready)**

### ALTERNATIVE SOURCES OF ENERGY

#### PART 1 (Suggested time: 10-11')

Good morning. Today we're going to look at alternative energy. **[PAUSE]** You probably have an idea of what alternative energy is. But let's start with a definition so that we are all clear about this term. Well, alternative energy is energy which is produced without the burning of fossil fuels. That is, alternative energy is produced without burning coal, petroleum or natural gas. **[PAUSE]** We need to develop alternative energy for two reasons: **1)** because our supply of fossil fuels is limited. I mean they will run out one day and **2)** because the burning of fossil fuels causes high emissions of carbon dioxide. As you know, carbon dioxide is one of the main causes of global warming. **[PAUSE]** In this lecture, we will look at three different types of alternative energy: solar energy, wind energy and nuclear energy. We will briefly discuss the history of each type of alternative energy. Then we will look at their advantages and disadvantages. **[PAUSE]**

Let's first look at solar energy. **[PAUSE]** Solar energy means energy from the sun. There are two basic kinds of solar energy: passive and active. **[PAUSE]** Passive solar energy is used for two purposes: for heating and for light. As you can imagine, passive solar energy has been used since ancient times. For example, ancient Chinese and Greek buildings faced south. But why south? **[PAUSE]** Well, in this way, they were able to use the sun to heat their homes during the winter. Constructing a building facing south may sound like a simple idea. However, this simple idea led to complex ways of regulating heat. **[PAUSE]** One of the most famous examples of buildings with heat regulation is known as the Socrates' Megaron House. The Megaron House allowed sunlight into buildings during the winter, but kept it out during the summer. In other words, the Socrates' Megaron House stayed warmer in the winter and cooler in the summer. **[PAUSE]** Today, passive solar energy is still used for many purposes from heating water to cooking. **[PAUSE]**

All right... Now, let's turn to the second and the most important kind of solar energy in modern times, that is, active solar energy. [PAUSE] When we say active solar energy, we mean the process of turning solar energy into electricity. Let's now see why active solar power was developed. In the 19th century, many people believed that coal resources would soon come to an end. Coal was the primary source of electrical energy during this time. [PAUSE] So, scientists began to look for ways of using energy from the sun. [PAUSE] In 1883, Charles Fritts, an American scientist, invented a way to turn energy from the sun into electricity. Today we call his invention the photovoltaic cell. Charles Fritts invented the photovoltaic cell, but his invention was **not** practical. [PAUSE]

In the early 20<sup>th</sup> century, the technology of photovoltaics gradually improved. In 1921, Albert Einstein won the Nobel Prize for his theories about the photoelectric effect. Well, the photoelectric effect is the science behind photovoltaics. So, Einstein contributed theoretically to the development of photovoltaics. [PAUSE] Finally, in 1954, the first **practical** photovoltaic cell was invented in Bell Laboratories. And since then, the technology of photovoltaics has improved greatly over the years. [PAUSE]

Now that we've seen what solar energy is and how it has developed over the years, we can look at its advantages. [PAUSE] First of all, solar energy is 100 percent renewable. In other words, as long as there is sunlight, we will have a source of energy. [PAUSE] Second, solar energy does not pollute the environment. The production of photovoltaic cells does of course produce some pollutants, but the negative effect on the environment is very little. Moreover, photovoltaic panels currently have a life-span of two to three decades, so once a photovoltaic panel is installed, you can expect to get at least twenty or thirty years of clean energy. [PAUSE] The third advantage of solar energy is that the photovoltaic panels require almost no maintenance. There are no moving parts, so there is nothing to break down. In normal circumstances, it is enough to clean a solar panel once a year. [PAUSE] To sum up, the advantages of solar energy are that it is renewable, clean and it requires little maintenance. [PAUSE]

Of course, there are some disadvantages of solar energy. **[PAUSE]** The most important disadvantage is that it is very expensive. The main expense is in the purchase of solar panels. Currently, the price of solar energy is at least twice as high as energy from coal. **[PAUSE]** The good news, however, is that the cost of solar energy is falling significantly. In our lifetimes, we can expect solar energy to become cheaper than energy from fossil fuels. **[PAUSE]** Another problem with solar energy is that the supply of sunlight is not constant, that is, sunlight is not always available. The sun only shines during the day, but of course we need electricity at night as well. This creates an even bigger problem during the winter, when days are shorter. **[PAUSE]** Of course we can store the electricity produced by solar panels for later use in most households. However, for industrial use, solar energy storage is still not enough. Luckily, just like the technology of solar panels, the technology of energy storage is improving, and we can expect a solution to this problem soon. **[PAUSE]** So just to repeat, the main disadvantages of solar energy are that it is expensive and that its supply is not constant. **[PAUSE]**

That's all about solar energy. In the second part of the lecture, we'll be dealing with wind and nuclear energy.

**896 words**

**PART 2 (Suggested time: 10-11')**

In the first part of the lecture, we saw solar energy as an alternative energy source. In the second part of the lecture, we'll take a look at wind and nuclear energy. **[PAUSE]**

First wind energy... **[PAUSE]** Well, people have been using wind power for thousands of years. So just like solar energy, wind energy is not a new source of energy for human beings. The first windmills were invented in Iran in the 9th century. So that was in the 800s. How about their shape? **[PAUSE]** Well, the first windmills were horizontal. In other words, they were parallel to the ground. **[PAUSE]**

Another type of windmill is the vertical windmill. We are all familiar with vertical windmills. They were first built in the 12th century. **[PAUSE]** Both types of windmills, I mean horizontal and vertical windmills, are still used for two mechanical purposes: pumping water or producing food. We use vertical windmills to produce electricity as well. **[PAUSE]** So electricity is the third reason why people use windmills. Today, windmills are most commonly used to produce electricity. **[PAUSE]**

The first windmill to produce electricity was built in the late 19<sup>th</sup> century. **[PAUSE]** In 1887, James Blyth built the first windmill specifically designed to produce electricity. Today we call such windmills wind turbines. In other words, a wind turbine is a vertical windmill which generates electricity. **[PAUSE]** Today, wind energy is produced on wind farms. Wind farms are large areas with many wind turbines. **[PAUSE]**

Let's take a look at some of the advantages of wind power. **[PAUSE]** First, like solar power, wind power is environmentally friendly. Wind turbines do not use any fossil fuels at all, so they don't produce any pollutants. **[PAUSE]** Second, wind is a renewable resource. As long as there is life on this planet, there will be wind. **[PAUSE]** Third, it is cheaper than electricity derived from fossil fuels. Yes, that's right. Unlike solar energy, wind energy is currently cheaper than energy derived from coal or other fossil fuels. **[PAUSE]** To sum up, the advantages include environmental friendliness, renewability and low cost. **[PAUSE]**

So if wind power is so cheap, why don't we get all of our energy needs from it? **[PAUSE]** Naturally there are some disadvantages of wind power. First of all, wind is unpredictable. Sometimes there is a lot of wind, and sometimes there is no wind at all. In other words, as with solar power, one of the problems with wind power is that wind is not consistent. **[PAUSE]** Similarly, as with solar power, there is the problem of energy storage. Until we find a way to store large amounts of electricity for long periods of time, we cannot rely on wind power as our main source of energy. **[PAUSE]** One final problem with wind power is noise. Wind turbines are not silent. In fact, the noise coming from a wind farm can be as loud as traffic on a busy street. **[PAUSE]** So the disadvantages of wind power include inconsistency, insufficient technology to store energy, and noise. **[PAUSE]**

The last kind of alternative energy we will look at is nuclear power. **[PAUSE]** What is nuclear power? **[PAUSE]** Basically, nuclear power makes use of the energy inside an atom. **[PAUSE]** There are two basic kinds of nuclear reaction: Nuclear fusion and nuclear fission. **[PAUSE]**

In nuclear fusion, two atoms are forced together and become one atom. This process creates a great amount of energy. Nuclear reactions in the sun are an example of nuclear fusion. The sun, you may know, is basically an enormous nuclear reactor. [PAUSE] To repeat, nuclear fusion brings two atoms together and creates a huge amount of energy. [PAUSE] However, there is no technology to bring about nuclear fusion on Earth. In fact, most nuclear physicists say creating nuclear fusion on Earth is almost impossible.

Let's turn now to nuclear fission. [PAUSE] Nuclear fission occurs when the nucleus of an atom is divided into smaller parts. [PAUSE] By the way, the nucleus is the center of an atom. [PAUSE] So here, the process is just the reverse of what happens in nuclear fusion. When the central part of an atom is divided into pieces, an enormous amount of energy is released. [PAUSE] All the nuclear power plants in the world today use nuclear fission to produce energy. [PAUSE]

Let's now look at some advantages of nuclear power in general. [PAUSE] Just like solar and wind power, nuclear power doesn't emit any greenhouse gases. That is, it doesn't cause global warming. [PAUSE] And the most important advantage is that, unlike solar or wind power, it produces a high amount of energy at a constant rate. In other words, a nuclear power plant is always producing energy, and it produces a large amount of energy. [PAUSE] So to repeat, nuclear power plants produce energy without releasing greenhouse gases. And most importantly, energy production is constant. There is always a large amount of energy. [PAUSE]

Finally, we'll look at some disadvantages of nuclear power in general. **[PAUSE]** If you remember, I said nuclear power does not emit greenhouse gases. However, this doesn't mean that it is 100% environmentally friendly. First of all, there is always the risk of a serious nuclear accident in a nuclear power plant. Nuclear accidents are serious because high amounts of radiation are released into the environment. **[PAUSE]** As you know, radiation affects human health and the environment very badly for a long time. **[PAUSE]** Second, there is the problem of storage. When I say storage, I don't mean storing the energy that is produced. I mean the storage of nuclear waste. Nuclear waste is the radioactive material produced by nuclear reactors. Because nuclear waste is dangerously radioactive, it should be stored safely for thousands of years. **[PAUSE]** Yes, nuclear waste remains radioactive for thousands of years, so its safe storage is a big problem.

By now, you probably realize that there is no perfect kind of alternative energy. Each kind has its advantages and disadvantages. **[PAUSE]** As our supply of fossil fuels runs out, solar, wind and nuclear power will become more important. The choice is up to us. We should choose the best alternative energy type for our needs and use it for the good of the people and the environment. **[PAUSE]**

This is the end of my lecture. Thank you for listening.

**1020 words**