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**DISCUSSING POWER ENGINEERING ISSUES
IN THE ACADEMIC CONTEXT**

(Английский язык для научно-исследовательской деятельности)

Учебное пособие

*Учебное пособие содержит сведения, необходимые для формирования универсальных и общепрофессиональных компетенций при подготовке магистрантов и рекомендуется Федеральным УМО в системе ВО по укрупненной группе специальностей и направлений подготовки 35.00.00
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Пособие включает материалы, связанные с проблематикой работы современного топливно-энергетического комплекса. Система упражнений направлена на расширение терминологического словарного запаса, формирование устойчивой мотивации к предстоящей профессиональной деятельности, решению и обсуждению профессиональных вопросов с зарубежными коллегами и работе с иноязычными источниками. Особенное внимание уделяется развитию информационно-аналитических и презентационных умений.

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The study manual focuses on some issues related to the modern power engineering industry. The system of exercises aims to broaden terminological vocabulary, develop sustained motivation for future professional activities, professional communication with international colleagues, and doing scientific research using foreign language sources. Particularly considered are presentation and public speaking skills.

Illustrative material is sourced from www.need.org (source #3 – the resource developers permit the free use of materials for educational purposes in classroom settings).

The manual is designed for Master's degree courses offered within the Federal State Educational Standard of Higher Education in training areas 35.04.06 “Agricultural Engineering,” 13.04.01 “Thermal Power Engineering and Heat Engineering,” and 13.04.02 “Power Industry and Electrical Engineering.”

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UNIT 1. POWER ENGINEERING BASICS

Learning outcomes

- Talking about the phenomenon of energy and its specific features
- Determining the difference between renewable and non-renewable energy sources
- Mastering the skills of describing pie charts

Starting point

1. *What do you remember from the course of physics about energy and power? Are these words synonyms?*
2. *Do you agree that all nonrenewable energy sources are represented by fossil fuels?*
3. *Give definitions of potential and kinetic energy in your own words.*

Task 1. Enlarge your vocabulary by restoring the offered words. Use the brainstorm activity method.

**ENERGY is
the a...y to do work**

There are two **types of energy**:

- Stored (p...) energy
- Working (k...) energy

Energy comes in different forms:

- E...
- Ch...
- G...
- G...
- H... (thermal)
- L... (radiant)
- M...n (kinetic)
- Nu...

Energy sources can be categorized as re...e or nonre...e.

Task 2. Insert the words given below into the blanks. Mind that there are three irrelevant words.

When we use electricity in our home, the electrical power was probably 1) by burning coal, by a 2) reaction, or by a 3) plant at a dam. Therefore, coal, nuclear and hydro are called energy 4). When we fill up a gas tank, the source might be 5) or ethanol made by growing and 6) corn.

Energy sources are divided into two groups — 7) (an energy source that can be easily replenished) and 8) (an energy source that we are using up and cannot 9)). Renewable and nonrenewable energy sources can be used to produce 10) energy sources including electricity and hydrogen.

generated, hydroelectric, nonrenewable, Physics, nuclear, petroleum, processing, recreate, renewable, additional, secondary, sources, production

Task 3. Determine the sources of renewable energy forms, which can be turned into electricity and heat.

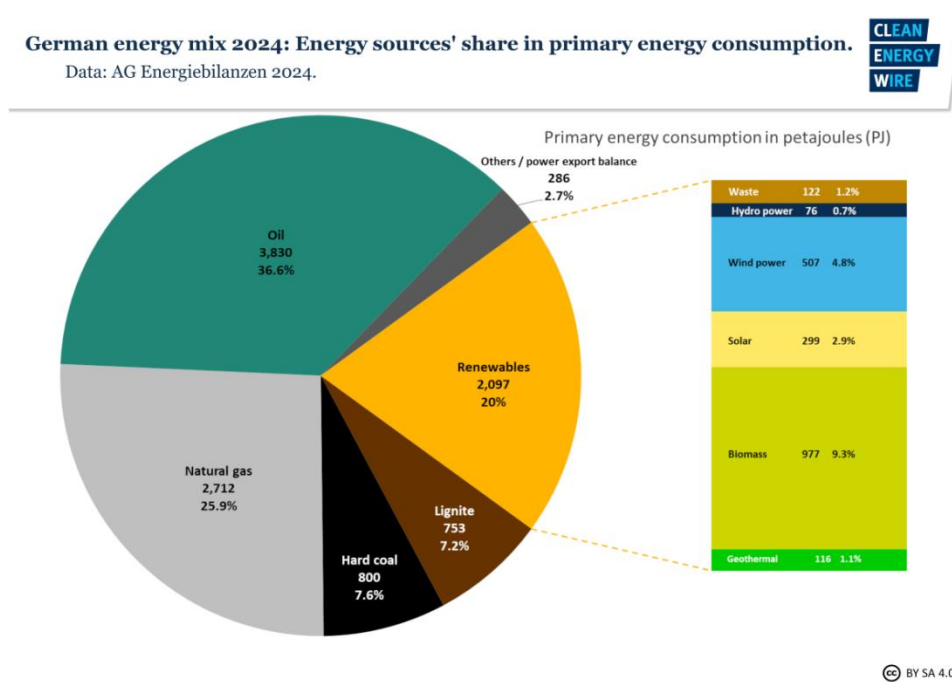
- | | |
|----------------------|---|
| 1) Biomass energy | a) the sun rays |
| 2) Geothermal energy | b) heat inside the Earth |
| 3) Hydropower | c) plants (firewood, corn ethanol, or biodiesel from vegetable oil) |
| 4) Solar energy | d) the rotation of hydroturbines at a dam |
| 5) Wind energy | e) strong air currents |

Task 4. Match the two sentence parts to form complete sentences.

1. We get most of our energy from nonrenewable energy sources ...	a. are nonrenewable.
2. They're called fossil fuels, ...	b. petroleum (oil), a nonrenewable resource.
3. Another nonrenewable energy source is the element uranium,	c. to generate the electricity we need for our homes, businesses, schools, and factories.
4. We use renewable and nonrenewable energy sources...	d. to name only a few uses.
5. Electricity "energizes" our computers, lights, refrigerators, washing machines, and air conditioners,...	e. which include the fossil fuels — oil, natural gas, and coal.
6. Most of the gasoline used in our cars and motorcycles and the diesel fuel used in our trucks are made from ...	f. because they were formed over millions and millions of years by the action of heat from the Earth's core and pressure from rock and soil on the remains (or "fossils") of dead plants and creatures like microscopic diatoms.
7. Natural gas, used to heat homes, dry clothes, and cook food, and the propane, made from it, ...	g. whose atoms we split (through a process called nuclear fission) to create heat and ultimately electricity.

Task 5. Describe the pie and bar charts using the offered patterns (Appendix 2). Then do a research project and find the relevant data for our country.

The chart below shows what energy sources Germany uses. Nonrenewable energy sources **account for** 80% of all energy used in the country. Biomass, the largest renewable source, **accounts for** over half (9.3%) of all renewable energy.



Task 6. Develop your reading comprehension skills. Look through the text and do the test offered below.

NONRENEWABLE ENERGY SOURCES

Energy sources are considered nonrenewable if their supplies are limited and they cannot be replenished (made again) in a short period of time. Petroleum, for example, was formed millions of years ago from the remains of ancient sea plants and animals. We can't make more petroleum in a short time. Renewable energy sources include biomass, geothermal energy, hydropower, solar energy, and wind energy. They are called renewable energy sources because they are naturally replenished. We use renewable energy sources mainly to make electricity.

Electricity and hydrogen are different from the other energy sources because they are secondary sources of energy. Secondary sources of energy — energy carriers — are used to store, move, and deliver energy in easily useable form. We

have to use another energy source to make electricity or hydrogen. In the United States, coal is the number one energy source for generating electricity. Today the cheapest way to get hydrogen is by separating it from natural gas, a nonrenewable energy source. Hydrogen can also be separated from water and renewables, but hydrogen made from these sources is currently too expensive to compete with other fuels. Scientists are working on ways to make hydrogen from water and renewables more affordable.

The four nonrenewable energy sources used most often are:

- Oil and petroleum products, including gasoline, diesel fuel, and propane
- Natural gas
- Coal
- Uranium (nuclear energy).

Nonrenewable energy sources come out of the ground as liquids, gases, and solids. Crude oil (petroleum) is the only commercial nonrenewable fuel that is naturally in liquid form. Natural gas and propane are normally gases, and coal is a solid. Coal, petroleum, natural gas, and propane are all considered fossil fuels because they were formed from the buried remains of plants and animals that lived millions of years ago. Uranium ore, a solid, is mined and converted to a fuel used at nuclear power plants. Uranium is not a fossil fuel, but is a nonrenewable fuel.

Do this test choosing the right answers and discuss your results in group.

No.	Question
1	<p>Выберите правильный ответ на вопрос. What is the purpose of secondary sources of energy? 1) to keep, transport, and supply energy in easily useable form 2) to store, hold, and extract energy in easily useable form 3) to take, move, and share energy in easily employable form</p>
2	<p>Выберите правильный ответ на вопрос. Из чего возникла нефть как полезное ископаемое? 1) из водорода 2) из останков древних растений и животных 3) в результате биохимических процессе в толще земной коры</p>
3	<p>Завершите предложение: Nonrenewables can't be easily ... 1) replaced; 2) returned; 3) restored</p>
4	<p>Завершите предложение: К невозобновляемым источникам энергии</p>

	<p>относятся: ...</p> <p>1) Пропан, уран, уголь, энергия ветра</p> <p>2) Дизельное топливо, уголь, природный газ, ядерная энергия</p> <p>3) Нефть, бензин, солнечная энергия, уран</p>
5	<p>Справедливо ли данное утверждение?</p> <p>Hydrogen made from water and renewables is currently rather cheap to use it instead of other fuels.</p> <p>1) нет</p> <p>2) да</p> <p>3) в тексте нет подобной информации</p>
6	<p>Справедливо ли данное утверждение?</p> <p>В настоящее время самое дешевое урановое топливо получают на американских АЭС.</p> <p>1) нет</p> <p>2) да</p> <p>3) в тексте нет подобной информации</p>
7	<p>Какое из этих утверждений содержится в тексте?</p> <p>1) All fossil fuels are nonrenewable, but not all nonrenewable energy sources are fossil fuels.</p> <p>2) Not all fossil fuels are renewable, but all nonrenewable energy sources are fossil fuels.</p> <p>3) All fossil fuels are nonrenewable, and all nonrenewable energy sources are fossil fuels.</p>
8	<p>Какое из этих утверждений содержится в тексте?</p> <p>1) Уран является ископаемым топливом, не являясь возобновляемым источником энергии.</p> <p>2) Уран является ископаемым возобновляемым источником энергии.</p> <p>3) Уран является невозобновляемым источником энергии.</p>

Task 7. Restore the order of the opening of a presentation.

- State the purpose of your presentation
- Get people's attention
- Introduce yourself
- Stating the structure and length of your speech
- State how you want to deal with questions
- Welcome the audience and encourage them

Task 8. Choose suitable patterns for each part.

Introducing yourself	Welcoming the audience and encouraging them	Stating the purpose of the presentation	Stating how you want to deal with questions	Stating the structure and length of your speech	Getting people's attention

1. As you know, I'm in charge of public relations.
2. Do you hear me well?
3. Feel free to ask any questions when I finish.
4. For those of you who don't know me, my name's Tom Stotter.
5. Good morning, ladies and gentlemen.
6. I am going to speak for about ...
7. I'm going to show you how we've made our first successful steps in the potentially huge Chinese market.
8. If I could have everybody's attention.
9. If we can start?
10. If you have any questions, I'll be happy to answer them as we go along.
11. I'm the new Marketing Manager.
12. It's my pleasure today to be talking to professional experts in this field.
13. I've divided my report into three parts/sections as follows: ...
14. Let's get started.
15. My name's Jane Shaw. I'm responsible for travel arrangements.
16. My report will be in three parts: ...
17. On behalf of Intel, I'd like to welcome you.
18. Perhaps we can leave any questions you have until the end?
19. Perhaps we should begin?
20. Thank you for coming today.
21. The report will take about ...
22. There will be plenty of time for questions at the end.
23. This afternoon, I'd like to report on my study into the German market.
24. This morning I'd like to present our new processor.

25. Today I'd like to discuss our failures in the Japanese market and suggest a new approach.
26. Welcome to Microsoft.
27. What I want to do is to tell you about our successes and failures in introducing new working patterns.
28. What I want to do this morning is to talk to you about our new mobile telephone system.

Task 9. Complete the monologue with the expressions given below.

If I could have everybody's **1)** **2)** morning. On **3)** of my company I would like to **4)** you all here this morning. My name is Martin Twist and I'm **5)** for customer service. This morning I'd like to **6)** our new guarantee service packages. If you have any **7)** you'd like to ask, I'd be happy to **8)** them.

behalf, questions, welcome, present, responsible, answer, good, attention

Task 10. Complete the monologue with the suitable expressions.

OK, let's **1)** started. **2)**, everyone. Thanks **3)** coming. As **4)** of you know, my **5)** is John Smith and I'm in **6)** of recruitment. **7)** I want to do this morning is to **8)** to you **9)** recent changes in employment law and **10)** you how that will mean changes in the way we recruit people. Feel **11)** to ask **12)** questions you like as we go along.

Task 11. Now, summarize what you have learnt from this unit. Prepare a short oral speech that should last at least for two minutes. Make a kind of plan to help you form the structure of your report. Use the learnt expressions to open your presentation.

UNIT 2. FORMS OF ENERGY

Learning outcomes

- Talking about different forms and sources of energy
- Enlarging vocabulary in the sphere of energy production and conservation
- Mastering the skills of reading comprehension and summarizing

Starting point

1. *What forms of energy do you use every day? Draw on practical examples.*
2. *Do you agree that heat energy is equivalent to thermal energy?*
3. *Do you remember the definition of efficiency from the course of physics? What is the difference between energy conservation and energy efficiency?*

Task 1. To begin with, refresh your knowledge gained in the previous unit.

Guess the missing words and letters to restore the incomplete sentences.

Scientists define energy as **1)** Modern **2)** ci...on is possible because we have learned how to **3)** energy from one form to another and use it to do work for us and to live more **4)** co...y. Energy is found in **5)** forms including light, heat, **6)** ch...l energy, and motion. Numerous forms of energy can all be **7)** into potential and kinetic ones.

Potential energy is **8)** st...d energy, or the energy of **9)** p...on – **10)** gr...al energy. Kinetic energy is the **11)** of waves, electrons, atoms, molecules, substances, and objects.

Task 2. Match energy forms with their definitions. State whether these forms refer to either potential or kinetic energy.

- | | | |
|------------------------|---------------------|------------------|
| • chemical energy | • mechanical energy | • radiant energy |
| • electrical energy | • motion energy | • heat energy |
| • gravitational energy | • nuclear energy | • sound |

1. delivered by tiny charged particles called electrons, typically moving through a wire. Lightning is an example of this form of energy in nature.
2. energy stored in an object's height. The higher and heavier the object is, the more energy of this kind it stores. When you ride a bicycle down a steep hill and pick up speed, this form of energy is being converted to motion energy. Hydropower is another example of this form of energy, where the dam "piles" up water from a river into a reservoir.
3. the vibration and movement of the atoms and molecules within substances. As an object is heated up, its atoms and molecules move and collide faster. This form of energy is the thermal energy in the Earth.
4. energy stored in the movement of objects. The faster they move, the more energy is stored. It takes energy to get an object moving, and energy is released when an object slows down. Wind is an example of this form of energy. A dramatic example of it is a car crash, when the car comes to a total stop and releases all its energy at once in an uncontrolled instant.
5. energy stored in the nucleus of an atom — the energy that holds the nucleus together. Very large amounts of energy can be released when the nuclei are combined or split apart. Nuclear power plants split the nuclei of uranium atoms in a process called fission. The sun combines the nuclei of hydrogen atoms in a process called fusion.
6. electromagnetic energy that travels in transverse waves. This form of energy includes visible light, x-rays, gamma rays and radio waves. Light is one type of this energy form. Sunshine is an example of this form of energy, which provides the fuel and warmth that make life on the Earth possible.
7. energy stored in objects by tension. Compressed springs and stretched rubber bands are its examples.
8. the movement of energy through substances in longitudinal (compression/rarefaction) waves. It is produced when a force causes an object or substance to vibrate — the energy is transferred through the substance in a wave. Typically, this energy form is far less than other forms of energy.
9. energy stored in the bonds of atoms and molecules. Batteries, biomass, petroleum, natural gas, and coal are its examples. This form of energy is converted into thermal energy when we burn wood in a fireplace or burn gasoline in a car engine.

Task 3. Match the sentence parts.

1. To scientists, "conservation of energy" does not mean ...	a. all the energy put in it into useful work.
2. Instead, the law of conservation of energy says that ...	b. energy is neither created nor destroyed.
3. When we use energy, it doesn't disappear as ...	c. involves a loss of usable energy.
4. A car engine burns gasoline, converting ...	d. not very efficient.
5. Solar cells change ...	e. radiant energy into electrical energy.
6. Energy changes form, but ...	f. saving energy.
7. "Energy efficiency" is the amount of ...	g. the chemical energy in gasoline into mechanical energy.
8. A perfect energy-efficient machine would change ...	h. the total amount of energy in the universe stays the same.
9. In reality, converting one form of energy into another form always ...	i. useful energy you get from any type of system.
10. In fact, most energy transformations are ...	j. we change it from one form of energy into another.

Task 4. Check how well you have remembered the materials of this unit.

1	Выберите правильный ответ на вопрос. Что такое 'энергетический' КПД? 1) количество полученной полезной энергии 2) отношение затраченной энергии к полезной энергии 3) эффективность работы установки по получению электроэнергии
2	Выберите правильный ответ на вопрос. What kind of energy does biomass refer to? 1) heat energy 2) potential energy 3) chemical energy
3	Завершите предложение: Сжатая пружина является примером ... 1) кинетической тепловой энергии 2) потенциальной механической энергии 3) сохраненной гравитационной энергии
4	Завершите предложение: Solar cells change radiant energy into ... 1) chemical energy 2) electrical energy 3) heat energy
5	Справедливо ли данное утверждение? Движение автомобиля происходит за счет преобразования химической энергии в механическую. 1) нет 2) да 3) в разделе нет подобной информации
6	Справедливо ли данное утверждение? The law of conservation of energy says that energy is either created or destroyed. 1) нет 2) да 3) в разделе нет подобной информации
7	Какое из этих утверждений содержится в тексте? 1) Звук образуется, когда сила заставляет предмет вибрировать. 2) Звук образуется, когда сила давления заставляет предмет двигаться. 3) Звук прекращается, когда сила перестает воздействовать на предмет.
8	Какое из этих утверждений содержится в тексте? 1) A dramatic example of motion is car acceleration when the car accumulates all its motion energy at once. 2) A good example of motion is car deceleration when the car releases all its motion energy gradually. 3) A vivid example of motion energy is a traffic accident, when the car stops sharply and releases all its motion energy at once.
9	Выберите правильный вариант перевода предложения. It takes energy to get an object moving, and energy is released when an object slows down. 1) Это берет энергию, чтобы заставить объект двигаться и энергия отпускается, когда предмет замедляется.

	<p>2) Энергия уходит на перемещение объекта, при этом она накапливается, когда предмет снижает свою скорость.</p> <p>3) Для движения предмета требуется энергия, и эта энергия высвобождается, когда предмет замедляет свое движение.</p>
10	<p>Выберите правильный вариант перевода предложения.</p> <p>Электрoэнергия возникает вследствие движения мельчайших заряженных частиц по проводу.</p> <p>1) Electric power is produce by small particles typically moved along a cable.</p> <p>2) Electrical energy is delivered by tiny charged particles moving through a wire.</p> <p>3) Electric energy is obtained by tiny charged parts that are typically moving across a circuit.</p>

Task 5. Choose patterns for each intention in your presentation.

Intentions	Patterns
1. to speak about a subject	<i>a. After a brief overview of the results, I'd like to discuss the implications.</i>
2. to tell smb about what has been done	<i>b. Before we go on to the figures, I'd like to take a look at the changes we have made.</i>
3. to examine	<i>c. First, I will tell you about the present situation, then go onto what we are going to do.</i>
4. to speak to smb to give information or instructions	<i>d. First, let's take a look at what we have achieved so far.</i>
5. to explain something by giving instructions	<i>e. Firstly, I would like to give you a brief overview of the situation.</i>
6. to give the main facts about something	<i>f. I will only give you a brief outline and explain how it affects you.</i>
7. to give some extra or missing information	<i>g. I'd like to outline the new policy and give you some practical examples.</i>
8. to give a short description with general information but no details	<i>h. I'd like to quickly fill you in on what has happened.</i>
9. to draw attention to or emphasize the important facts	<i>i. I'd now like to go on to highlight some of the advantages that these changes will bring.</i>
10. to talk about ideas or opinions in more detail.	<i>j. I'll give you an overview of our objectives and then hand over to Peter for more details.</i>
	<i>k. I'm going to be reporting on our results achieved last quarter.</i>
	<i>l. I'm going to be talking to you about the results of our survey.</i>
	<i>m. I'm now going to go on to discuss our options in more detail.</i>
	<i>n. The object of this morning's talk is to show you how to put the theory into practice.</i>
	<i>o. The results highlight our strengths and our weaknesses.</i>
	<i>p. Today I will be reporting on the progress we have made since our last meeting.</i>
	<i>q. Today I'd like to talk about our plans for the new site.</i>
	<i>r. Today I'm going to show you how to get the most out of the new software.</i>
	<i>s. When I have finished outlining the policy, Jerry will fill you in on what we want you to do.</i>
	<i>t. When I have finished, Jack will then tell you about what is happening in Europe.</i>

Task 6. Match the sentence parts.

1. Today I'd like to talk ...	a. about our plans for the new market.
2. I'm going to be reporting ...	b. at what we have achieved so far.
3. First, let's take a look ...	c. brief overview of the situation.
4. First, I will tell ...	d. how to put the theory into practice.
5. The object of this morning's talk is to show you ...	e. in on what has happened.
6. I'd like to outline the ...	f. new policy and give you some practical examples.
7. I'd like to quickly fill you ...	g. on our results achieved last quarter.
8. Firstly, I would like to give you a ...	h. our options in more detail.
9. The results highlight our ...	i. strengths and weaknesses.
10. I'm going to go on to discuss ...	j. you about the present situation, then go onto what we are going to do.

Task 7. Complete the text with the words given below.

1. First, I wish to tell you **1)** the present **2)**, then go onto what we are going to do.
2. I'd like to quickly **3)** you **4)** on what has happened.
3. First, let's **5)** a look **6)** what we have achieved so far.
4. **7)**, I would like to give you a brief **8)** of the situation.
5. I'd like to **9)** the new policy and give you some practical **10)**.
6. I'm going to be **11)** on our results **12)** last quarter.
7. The **13)** of this morning's talk is to **14)** you how to put the theory into practice.
8. I'm going to go on to **15)** our options in more **16)**.
9. The results **17)** our strengths and **18)**.
10. Today I'd like to **19)** about our **20)** for the new market.

firstly, at, overview, talk, highlight, object, situation, reporting, detail, plans, in, weaknesses, discuss, fill, outline, achieved, about, examples, show, take

Task 8. Match the sentence parts and translate orally the English part into Russian and the Russian one – into English.

1. I'm going to be talking to you ...	a. вам о том, что происходит в Европе.
2. Today I'll be reporting ...	b. детально практические моменты.
	c. результаты, достигнутые с момента нашей

3. Before going on to the figures, let's take a ...	последней встречи.
4. When I have finished, Jack will then tell ...	d. как извлечь максимальную пользу из этого программного обеспечения.
5. Today, I'm going to show you ...	e. некоторые преимущества, к которым могут привести эти изменения.
6. I will only give you a brief ...	f. о наших целях, а затем передать слово коллеге для дальнейшей конкретизации этого вопроса.
7. After my outlining the policy, X. will ...	g. о результатах нашего исследования.
8. I'll give you an overview ...	h. обзор и объяснить, каким образом эта ситуация относится к вам.
9. I'd like to go on to highlight ...	i. описать вам наши дальнейшие действия.
10. After a brief overview of the results, I'd like to discuss ...	j. предложит рассмотреть совершенные нами изменения.

Task 9. Complete the text.

1. When I have finished, Jack will then **1)** you about **2)** is happening with our competitors.
2. Today, I'm going to **3)** you how to get the **4)** out of the government new policy.
3. I'll **5)** you an overview of our objectives and then **6)** over to my colleague for more details.
4. When I have finished **7)** the policy, my colleague will **8)** you in on what we want you to do.
5. Today I'll be **9)** on the progress we have **10)** since last year.
6. I'm going to be **11)** to you about the **12)** of our survey.
7. I will only give you a brief **13)** and **14)** how it concerns you all.
8. Before we **15)** on to the figures, I'd like to **16)** a look at the recent changes we have made.
9. I'd like to go on to **17)** some of the advantages these changes will **18)**.
10. After a brief **19)** of the results, I'd like to **20)** the implications in more detail.

Task 10. Look through the text and prove the main difference between energy conservation and energy efficiency in a short presentation.

The terms energy conservation and energy efficiency have two distinct definitions. There are many things we can do to use less energy (conservation) and use it more wisely (efficiency).

Energy conservation is any behavior that results in the use of less energy. Turning the lights off when you leave the room and recycling aluminum cans are both ways of conserving energy.

Energy efficiency is the use of technology that requires less energy to perform the same function. A compact fluorescent light bulb that uses less energy than an incandescent bulb to produce the same amount of light is an example of energy efficiency. However, the decision to replace an incandescent light bulb with a compact fluorescent is an act of energy conservation.

UNIT 3. OIL AS A POWER SOURCE

Learning outcomes

- discussing the origin of oil and production stages of petroleum products
- determining the distinctive features of various petroleum products
- mastering the skills of rendering pictures into text information

Starting point

1. *What do you remember from the course of geography about oil origin?*
2. *Do you agree that petroleum products cause considerable harm to the environment?*
3. *What are the main alternatives to the use of gasoline and other petroleum products?*

Task 1. a) find the English equivalents for the offered words and word combinations: *останки, сырая нефть, жидкость с характерным запахом, образцы породы, месторождение, бурение, скважина, вышка, нефтеперерабатывающее предприятие, трубопровод, нефтепродукты, перегонка (очистка);*

b) comment on the meaning of the words 'oil', 'petroleum', and 'refinery';

c) make a schematic diagram of the production process of petroleum products.

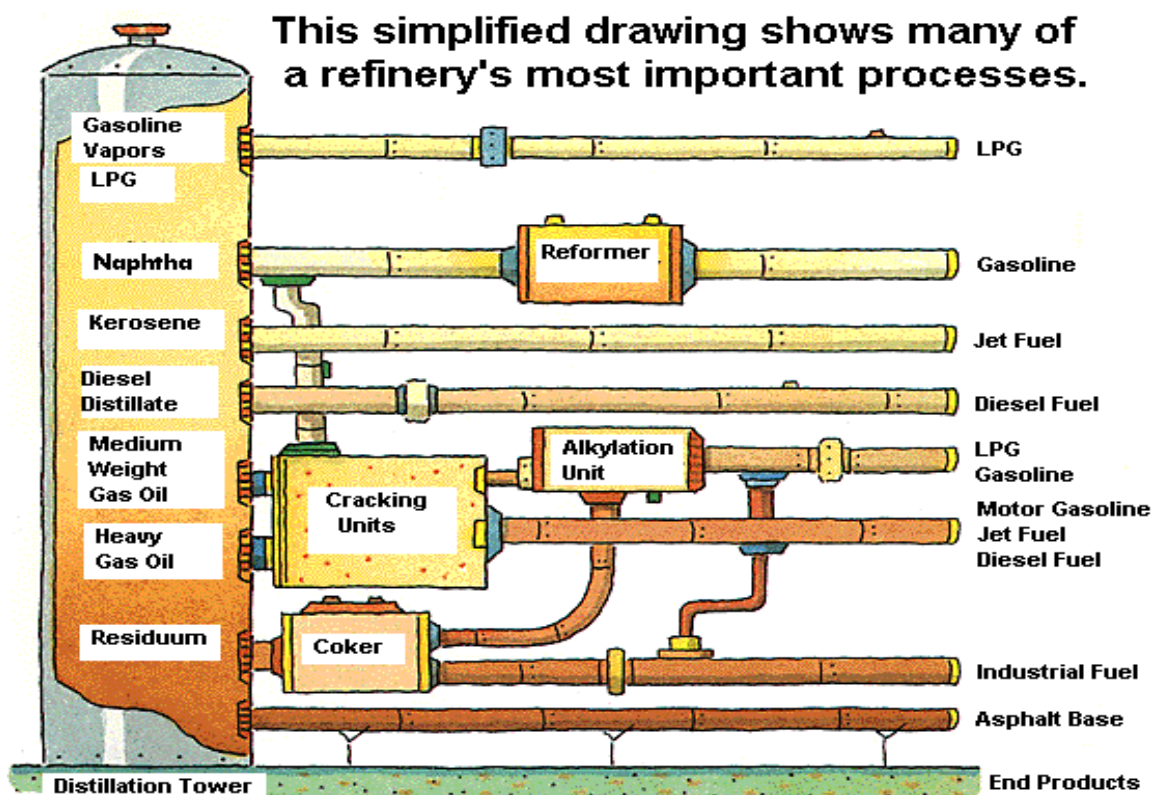
Oil was formed from the remains of animals and plants (diatoms) that lived millions of years ago in a marine (water) environment. Over millions of years, these remains were covered by layers of sand and silt. Heat and pressure helped the remains turn into what we today call crude oil. The word "petroleum" means "rock oil" or "oil from the earth." Crude oil is a smelly, yellow-to-black liquid and is usually found in underground areas called reservoirs. Scientists and engineers explore a chosen area by studying rock samples from the earth. Measurements are taken, and, if the site seems promising, drilling begins. Above the hole, a structure

called a 'derrick' is built to house the tools and pipes going into the well. When finished, the drilled well will bring a steady flow of oil to the surface.

After crude oil is removed from the ground, it is sent to a refinery by pipeline, ship, or barge. At a refinery, different parts of the crude oil are separated into useable petroleum products. Crude oil is measured in barrels (abbreviated "bbls"). One barrel of crude oil, when refined, produces about 19 gallons of finished motor gasoline, and 10 gallons of diesel, as well as other petroleum products. Most petroleum products are used to produce energy.

As mentioned above, they separate different parts of the crude oil into useable petroleum products at a refinery. Essentially, refining breaks crude oil down into its various components, which then are selectively reconfigured into new products.

Task 2. Have a look at this diagram and try to express its general idea. Offer the Russian equivalents for all the terms used here.



Task 3. Analyze the passages given below, put them into the correct order and state which of them describe the following processes: treatment, conversion, storage, separation.

1) Both the incoming crude oil and the outgoing final products need to be stored. These liquids are stored in large tanks on a tank farm near the refinery. Pipelines then carry the final products from the tank farm to other tanks all across the country.

2) Cracking and rearranging molecules take a heavy, low-valued feedstock — often itself the output from an earlier process — and change it into lighter, higher-valued output such as gasoline. The most widely used method is called cracking because it uses heat and pressure to "crack" heavy hydrocarbon molecules into lighter ones. A cracking unit consists of one or more tall, thick-walled, bullet-shaped reactors and a network of furnaces, heat exchangers, and other vessels. Other refinery processes, instead of splitting molecules, rearrange them to add value. Alkylation, for example, makes gasoline components by combining some of the gaseous byproducts of cracking. The process is essentially cracking in reverse. Reforming uses heat, moderate pressure, and catalysts to turn naphtha, a light, relatively low-value fraction, into high-octane gasoline components.

3) Heavy petroleum components or "fractions" are on the bottom; light fractions are on the top. This difference in weights allows the separation of the various petrochemicals. Modern separation involves piping oil through hot furnaces. The resulting liquids and vapors are discharged into distillation towers. Inside the towers, the liquids and vapors separate into fractions according to weight and boiling point. The lightest fractions, including gasoline and liquid petroleum gas (LPG), vaporize and rise to the top of the tower, where they condense back to liquids. Medium weight liquids, including kerosene and diesel oil distillates, stay in the middle. Heavier liquids, called gas oils, separate lower down, while the heaviest fractions with the highest boiling points settle at the bottom.

4) To make gasoline, refinery technicians carefully combine a variety of streams from the processing units. Among the variables that determine the blend are octane level, vapor pressure ratings and special considerations, such as whether the gasoline will be used at high altitudes.

Task 4. Choose suitable structures for each signposting action.

There are certain key words we use to 'signpost' different stages in our presentation. It is absolutely essential that you memorize them and can use them when giving a presentation.

Actions	Signposting structures
1. When you want to make your next point.	a. Digressing for a moment, I'd like to say a few words about our problems in Chicago.
2. When you want to change to a completely different topic	b. Going back to something I said earlier, the situation in Chicago is serious. c. I don't have a lot of time left so I'm going to summarize the next few points.
3. When you want to give more details about a topic	d. I don't want to elaborate any more on that as I'm short of time. e. I'd like to conclude by leaving you with this thought
4. When you want to talk about something which is off the topic of your presentation	f. I'd like to digress here for a moment and just say a word of thanks to Bob for organizing this meeting. g. I'd like to expand more on this problem we have had in Chicago.
5. When you want to refer back to an earlier point	h. I'd like to go back to something Jenny said in her presentation. i. I'd like to move on to the next point if there are no further questions
6. To just give the outline of a point	j. I'd like to quickly recap the main points of my presentation. k. I'd like to turn to something completely different.
7. To repeat the main points of what you have said	l. If I could just summarize a few points from John's report. m. If I may conclude by quoting Karl Marx
8. For your final summarizing remarks	n. Let's turn now to our plans for next year. o. Moving on to the next point. p. Recapping quickly on what was said before lunch,..... q. Would you like me to expand a little more on that or have you understood enough?

Task 5. Insert the missing words and phrases into the blanks.

1. I'd like to *I*) to something completely different.
2. *2*) for a moment, I'd like to say a few words about the counterpart model.

3. I'd like to **3)** to the next point in case there are no further questions.
4. **4)** to something I said earlier, the market situation is serious.
5. I don't want to **5)** any more on that as I'm short of time.
6. I'd like to **6)** here for a moment and just say a word of thanks to our Marketing Department.
7. I'd like to **7)** more on this problem with the competitors.
8. Let's **8)** now to our plans for next year.
9. **9)** to the next point.
10. Would you like me to **10)** a little more on that?

expand (2), turn (2), going back, elaborate (2), moving on, digress, digressing

Task 6. Complete the phrases with the suitable expressions or prepositions.

1. I'd like to **1) 2)** something the previous speaker said in his presentation.
2. If I could just **3)** a few points **4)** John's report.
3. I don't have a lot of time **5)** so I'm going to **6)** the next few points.
4. I'd like to quickly **7)** the main points **8)** my presentation.
5. **9)** quickly **10)** what was said before lunch, ...
6. I'd like to **11)** by **12)** you with this thought ...
7. If I may **13) 14)** quoting Adam Smith ...

Task 7. Analyze the environmental effects of oil production and render this text in Russian. Then prepare a short presentation on the strategies of minimizing negative ecological outcomes of this industry: "Emissions and Byproducts Produced from Burning Petroleum Products."

Petroleum products give off some emissions when they are burnt as fuel:

- Carbon dioxide (CO₂);
- Carbon monoxide (CO);
- Sulfur dioxide (SO₂);
- Nitrogen oxides (NOX) and Volatile Organic Compounds (VOC);
- Particulate matter (PM);

- Lead and various air toxics such as benzene, formaldehyde, acetaldehyde, and 1,3-butadiene (for some types of petroleum products burnt).

Nearly all of these byproducts have negative impacts on the environment and human health:

- Carbon dioxide is a greenhouse gas and a source of global warming.
- SO₂ causes acid rain, which is harmful to plants and animals that live in water, and it worsens or causes respiratory illnesses and heart diseases, particularly in children and the elderly.
- NOX and VOCs contribute to ground-level ozone, which irritates and damages the lungs.
- PM results in hazy conditions in cities, and, along with ozone, contributes to asthma and chronic bronchitis, especially in children and the elderly. Very small, or “fine PM” is also thought to cause emphysema and lung cancer.

Lead can have severe health impacts, especially for children, and air toxics are known or probable carcinogens.

UNIT 4. PROPANE AND NATURAL GAS AS POWER SOURCES

Learning outcomes

- Talking about the gas production and industrial use
- Determining the difference between liquefied-petroleum gases
- Mastering the skills of rendering pictures into texts

Starting point

1. *What do you remember from the course of physics about gases?*
2. *Do you agree that natural gas is a fossil fuel?*
3. *Can propane be obtained from natural gas only?*

Task 1. Offer the English equivalents for the given words and expressions.

Энергоемкий, при высоком/умеренном давлении, в жидком состоянии, фракционная установка, без цвета и запаха, зловонный, легко определять утечки газа, вильчатый погрузчик, выхлопы, углеводород, газы, вызывающие парниковый эффект.

Task 2. Look through the text and answer the following questions.

1. *Name liquefied petroleum gases mentioned in the text. How are they formed?*
2. *The amount of propane produced from natural gas and from oil is actually the same, isn't it?*
3. *Why is propane transported and stored in a liquid state?*
4. *How can propane turn from its liquid into gas state again?*
5. *What kind of fuel does propane refer to? What are its typical features?*
6. *Why is mercaptan added to propane?*
7. *What are the main advantages of propane and ways of its utilizing?*

Propane is an energy-rich gas, C_3H_8 . It is one of the liquefied petroleum gases (LP-gases or LPGs) that are found mixed with natural gas and oil. Propane and other liquefied gases, including ethane and butane, are separated from natural gas, or from crude oil. The amount of propane produced from natural gas and from oil is roughly equal. Propane naturally occurs as a gas. However, at higher pressure or lower temperatures, it becomes a liquid. Because propane is 270 times more compact as a liquid than as a gas, it is transported and stored in its liquid state. Propane becomes a gas again when a valve is opened to release it from its pressurized container. Liquefied petroleum gases are mixtures of propane, ethane, butane, and other gases that are produced at natural gas processing plants and refineries. Fractionation plants then separate the liquids from each other. LP-gases were discovered in 1912 when a U.S. scientist, Dr. Walter Snelling, found out that these gases could be changed into liquids and stored under moderate pressure.

Propane is a nonrenewable fossil fuel, like the natural gas and oil it is produced from. Like natural gas (methane), propane is colorless and odorless. Although propane is nontoxic and odorless, foul-smelling mercaptan is added to it to make gas leaks easy to detect. Propane is a clean burning fossil fuel, that is why it is often chosen to fuel indoor equipment such as forklifts. Its clean burning properties and its portability also make it popular as an alternative transportation fuel. Propane-fueled engines produce much fewer emissions of carbon monoxide and hydrocarbons compared to gasoline engines. Like all fossil fuels, propane emits water vapor and carbon dioxide, a greenhouse gas.

Task 3. Render this text into Russian (choose the most important facts).

Task 4. Insert the words into the blanks. There are three irrelevant words.

The main **1)** in natural gas is methane, a gas (or compound) composed of one carbon atom and four **2)** atoms. **3)** natural gas is also known as consumer-grade natural gas. Liquefied natural gas (LNG) is natural gas that has been **4)** to about $-260^{\circ}F$ for shipment and/or storage as a liquid. Liquefying natural gas

provides a means of moving it long distances where pipeline transport is not 5), allowing access to natural gas from regions with vast production potential that are too 6) from end-use markets to be connected by 7).

Natural gas has many qualities that make it an efficient, relatively 8), and economical energy source. However, it is made up mostly of methane, which is a very potent 9) gas. Some methane 10) into the atmosphere from coal mines, oil and gas wells, and natural gas storage tanks, pipelines, and processing plants.

clean, cooled, distant, dry, feasible, green, greenhouse, hydrogen, ingredient, expedient, leaks, lost, pipeline

Task 5. Choose suitable structures for each signposting action.

In modern English, presentations tend to be much less formal than they used to be. Most audience prefer a relatively informal approach. However, there are certain structures you should observe.

Actions	Survival language structures
1. If you get your facts wrong.	a. As we are short of time, this is just a quick summary of
2. If you have been going too fast and your audience is having trouble keeping up with you.	the main points.
3. If you have forgotten to make a point.	b. I am terribly sorry. What I meant to say was this.
4. If you have been too complicated and want to simplify what you said.	c. I want to recap briefly on what I have been saying.
5. If you realize that what you are saying makes no sense.	d. If I can just go back to the previous point, there is something else that I forgot to mention.
6. If you cannot remember the term in English.	e. Let me just recap on that.
7. If you are short of time.	f. Let me rephrase that to make it quite clear.
	g. So just to give you the main points.
	h. So, basically, the point I am trying to get across is this.
	i. So, basically, what I am saying is this.
	j. Sorry, I should just mention one more thing.
	k. Sorry, my mind has gone blank. How do you say 'gasoline' in British English?
	l. Sorry, perhaps I did not make that quite clear.
	m. Sorry, what is the word I am looking for?
	n. Sorry. What I meant is this.

Task 6. Insert the missing words and phrases into the blanks.

1. I'm terribly sorry. What I 1) to say was this.
2. I want to 2) briefly on what I have been saying.

3. If I can just go back to the previous 3), there is something else I forgot to 4).
4. So, 5), the point I am trying to get 6) is this.
5. Let me 7) that to make it quite clear.
6. Sorry, what is the 8) I am 9).
7. As we are short of time, there is just a quick 10) of the 11) points.

looking for, basically, word, rephrase, across, mention, meant, recap, point, main, summary

Task 7. Complete the phrases with the suitable expressions or prepositions.

1. I am 1) sorry. What I meant to say was this.
2. Sorry, I should just 2) one more thing.
3. If I can just go back to the 3) point, there is something else that I 4) to mention.
4. Sorry, my mind has gone 5). How do you say 'truck' in British English?
5. Sorry, 6) I did not make that 7) clear.

Task 8. Translate the sentences into English

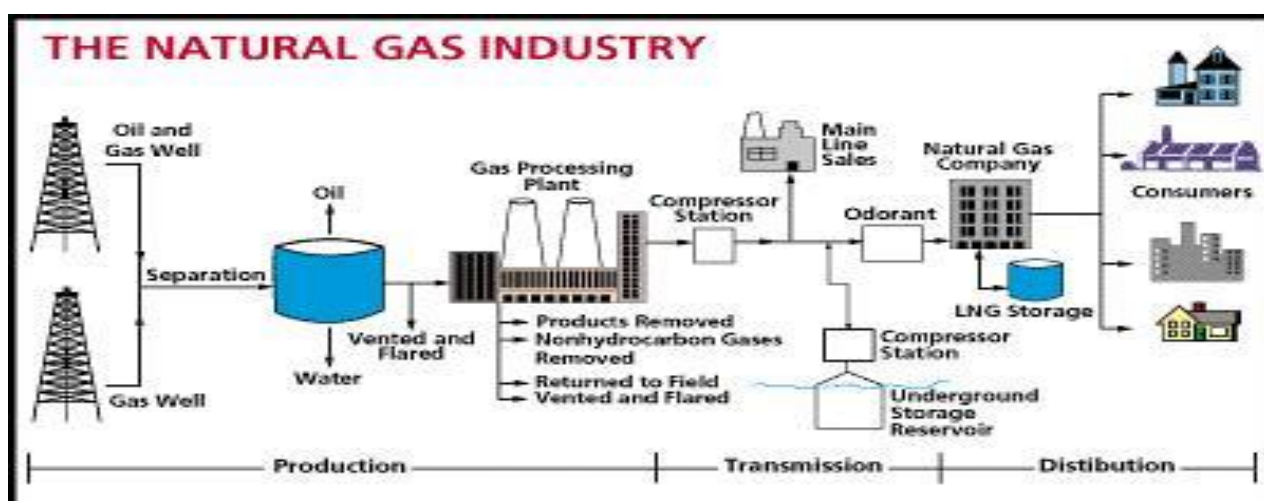
1. Рад приветствовать всех вас от лица РГАУ-МСХА имени К.А.Тимирязева.
2. Сейчас я расскажу вам о наших успехах и неудачах на рынке импорта сельхозтехники.
3. Вы можете задавать мне любые вопросы по окончании моего доклада.
4. Поскольку у меня мало времени, я больше не буду задерживаться на этом вопросе.
5. Отступив на секунду в сторону от темы выступления, я напомним вам слова Мичурина.
6. Сегодня я сообщу вам о наших достижениях с момента предыдущей встречи.
7. Перед тем, как перейти к цифрам, давайте обобщим наши неудачи.
8. Я сделаю обзор наших целей и способов их практического достижения.

9. Результаты ярко показывают наши сильные и слабые стороны.
10. После того, как я опишу нашу политику в общих чертах, мой коллега завершит картину рассказом о том, чего мы хотим добиться.

Task 9. Offer your solutions to the given problems.

1. Описывая новую модель двигателя, вы понимаете, что аудитории незнакомо слово, без которого невозможно полностью понять смысл предлагаемой инновации (например, «газохол»). Предложите способ решения проблемы (2-3 предложения на иностранном языке).
2. Описывая новую модель двигателя, вы понимаете, что вы забыли точный английский эквивалент термину (например, «тепловой КПД», «многолетние растения» и т.п.). Предложите способ решения проблемы (2-3 предложения на иностранном языке).
3. Описывая экологические характеристики предлагаемой технологии, вы обнаруживаете, что среди аудитории находятся противники данного подхода. Предложите способ решения проблемы (2-3 предложения на иностранном языке).
4. Описывая экологические характеристики предлагаемой технологии, вы обнаруживаете, что указали фактически неточные данные по параметрам выбросов продуктов сгорания в атмосферу. Предложите способ решения проблемы (2-3 предложения на иностранном языке).
5. Описывая какой-либо сложный процесс (например, рабочий цикл 5-тактного ДВС и т.п.), вы чувствуете, что вас не совсем понимают слушатели. Предложите способ решения проблемы (2-3 предложения на иностранном языке).

Task 10. Prepare a short presentation on “Getting Natural Gas to Users”.



UNIT 5. POWER PRODUCTION FROM COAL

Learning outcomes

- Talking about the coal types and their specific features
- Describing the process of coal mining and transporting
- Mastering the skills of describing flow charts

Starting point

1. *What do you remember from the course of physics about coal?*
2. *Why is coal mining so important for the national economy and industry?*
3. *Do you agree that the industrial use of coal is harmful for the environment?*

Task 1. Find the English equivalents for the following Russian words and expressions: *горючий, осадочная порода, углеводороды, болотистый, слой, останки растений, угольное месторождение, тип угля (степень углефикации).*

Coal is a combustible black or brownish-black sedimentary rock composed mostly of carbon and hydrocarbons. The energy in coal comes from the energy stored by plants that lived hundreds of millions of years ago, when the Earth was partly covered with swampy forests. The heat and pressure from the top layers helped the plant remains turn into what we today call coal.

Coal is classified into **four main types**, or ranks (**anthracite, bituminous, subbituminous**, and **lignite**), depending on the amounts and types of carbon it contains and on the amount of heat energy it can produce. The rank of a coal deposit depends on the pressure and heat acting on the plant debris as it sank deeper and deeper over millions of years. For the most part, the higher ranks of coal contain more heat-producing energy.

Task 2. Look through the text again and do the tasks.

1. Describe the process of coal formation.
2. State the relation between the depth of coal deposition and its heat-producing capacity.

Task 3. Match the terms (types of carbon) and their definitions.

1. Anthracite	a. contains 45-86% carbon, is used to generate electricity and is an important fuel and raw material for the steel and iron industries.
2. Bituminous coal	b. contains 86-97% carbon, and generally has a heating value slightly higher than bituminous coal.
3. Lignite	c. has a lower heating value than bituminous coal and typically contains 35-45% carbon.
4. Subbituminous coal	d. is the lowest rank of coal with the lowest energy content. Its deposits tend to be relatively young coal deposits that were not subjected to extreme heat or pressure, containing 25%-35% carbon. It is crumbly and has high moisture content.

Task 4. Insert the words into the appropriate blanks in the text. Mind that there are some irrelevant words.

Mining and Transporting Coal

Coal miners use giant machines to **1)** ... coal from the ground. They use two methods: surface or underground mining. **2)** ... **mining** (including mountain top removal) is less expensive than **3)** ... mining. **4)** ... mining can be used when the coal is buried **5)** ... than 200 feet underground. In **6)** ... mining, giant machines remove the top soil and layers of rock known as "**7)** ... " to expose the coal seam. Once the mining is finished, the dirt and rock are returned to the **8)** ... , the **9)** ... is replaced, and the area is **10)** **11)** ... , sometimes called deep mining, is used when the coal is buried several hundred feet below the **12)** To **13)** ... coal in these underground mines, miners ride elevators down deep mine **14)** ... where they run machines that **15)** ... the coal.

After coal comes out of the ground, it typically goes on a **16)** ... to a preparation plant that is located at the mining site. The plant cleans and processes coal to remove other rocks and dirt, ash, sulfur, and **17)** ... materials, increasing the

heating **18**) ... of the coal. After coal is **19**) ... and processed, it is ready to be shipped to **20**) The cost of shipping coal can be **21**) ... than the cost of mining it.

conveyor belt, dig out, higher, less, lower, market, mined, overburden, pit, remove (2), replanted, shafts, surface (4), topsoil, underground (2), unwanted, value, vast

Task 5. Comment on different uses of coal

For Electric Power	For Industry

1. A variety of industries use coal's heat and by-products.
2. Coal is baked in hot furnaces to make coke, which is used to smelt iron ore into iron needed for making steel. It is the very high temperatures from the use of coke that give steel the required strength and flexibility.
3. Industries with their own power plants use coal to generate electricity.
4. Power plants burn coal to make steam that turns turbines generating electricity.
5. Separated ingredients of coal (such as methanol and ethylene) are used in making plastics, tar, synthetic fibers, fertilizers, and medicines.
6. The concrete and paper industries also use large amounts of coal.

Task 6. Translate the sentences basing on the text “Reducing the Impacts of Coal Use”

Industry has found several ways to reduce sulfur, nitrogen oxides (NOX), and other impurities from coal, as well as more effective ways of cleaning coal after it is mined, and coal consumers have shifted towards greater use of low sulfur coal.

Power plants use flue gas desulfurization equipment known as "scrubbers", to clean sulfur from the smoke before it leaves smokestacks. In addition, industry and government have cooperated to develop technologies that can remove impurities from coal or make coal more energy-efficient so less needs to be burned.

Equipment intended mainly to reduce SO₂ (scrubbers), NO_x (catalytic converters), and particulate matter (electrostatic precipitators and baghouses) is also

able to reduce mercury emissions from some types of coal. Scientists are also working on new ways to reduce mercury emissions from coal-burning power plants.

Research is underway to address emissions of carbon dioxide from coal combustion. Carbon capture separates CO₂ from emissions sources and recovers it in a concentrated stream. The CO₂ can then be sequestered, which puts CO₂ into storage, possibly underground, in such a way that it will remain there permanently.

Reuse and recycling can also diminish environmental impact of coal. Land previously used for coal mining can be reclaimed for other uses. Waste products can also be captured by scrubbers to produce synthetic gypsum for wallboard.

Существует несколько эффективных способов очистки добытого угля от серы, оксидов азота и прочих примесей. В промышленности используются установки по обессериванию угля, которые называются газопромыватели и которые очищают топочный газ от серы до его выхода через дымовую трубу. Оксиды азота удаляются с помощью каталитических нейтрализаторов газов, а мелкие включения – электрофильтрами и рукавными пылеуловителями. Разрабатываются также новые способы снижения концентрации ртути в выбросах электростанций. Ведутся исследования по выделению и задерживанию в подземных резервуарах углекислого газа, образующегося при сгорании угля. Негативное воздействие угля на окружающую среду достигается за счет его вторичного использования и переработки, в частности, например, отходы угольной промышленности могут быть использованы для получения синтетического гипса.

Task 7. Translate the text “Coal & the Environment” into Russian.

Environmental laws and modern technologies have greatly reduced the impact on the environment from the production and consumption of coal. Without proper care, mining can have a negative impact on ecosystems and water quality and alter landscapes and scenic views. Debris that chokes mountain streams can result from surface mining like mountaintop removal, and acidic water can drain

from abandoned underground mines. Today restoring the land damaged by surface mining is an important part of the mining process. Because mining activities often come into contact with water resources, coal producers must also go to great efforts to prevent damage to ground and surface waters.

The combustion of coal produces several types of emissions that adversely affect the environment. The five principal emissions associated with coal consumption in the energy sector are:

- Sulfur dioxide (SO₂), which has been linked to acid rain and increased incidence of respiratory illnesses;
- Nitrogen oxides (NO_x), which have been linked to the formation of acid rain and photochemical smog;
- Particulates, which have been linked to the formation of acid rain and increased incidence of respiratory illnesses;
- Carbon dioxide (CO₂), which is the primary greenhouse gas emission;
- Mercury, which has been linked with both neurological and developmental damage in humans and other animals. Mercury concentrations in the air usually are low and of little direct concern. However, when mercury enters water — either directly or through deposition from the air — biological processes transform it into methylmercury, a highly toxic chemical that accumulates in fish and the animals (including humans) that eat fish.

Task 8. Separate the following verbs into three categories according to the expressed trends.

When we are giving a presentation, we often talk about changes. Usually we illustrate these changes with visual aids to show these changes. We need, however, to explain these changes. To do this, we need special verbs.

Rising	Falling	Stop rising or falling

take off, decrease, grow, level off, peak, shoot up, increase, improve, slump, shrink, expand, recover, bottom out, pick up, decline

Task 9. Find appropriate definitions to the given verbs

Verbs	Meaning
1. bottom out	a. to become larger or higher
2. decline	b. to increase in number or size very quickly
3. expand	c. to grow or become higher
4. fall	d. to start being successful or popular
5. fluctuate	e. to get better
6. grow	f. to become better or stronger, increase or improve
7. improve	g. to make, get or become better
8. increase	h. to get bigger (in size or number)
9. level off	i. to get larger (esp. in volume)
10. peak	j. to become smaller (in size or number)
11. pick up	k. to drop suddenly
12. recover	l. to become smaller (in size or amount), to contract or compress
13. rise	m. to become worse or smaller in number
14. shoot up	n. to stop falling or rising
15. shrink	o. to reach the highest point before falling
16. slump	p. to change continuously
17. take off	q. to reach the lowest point before improving

Task 10. Insert the words from those given below.

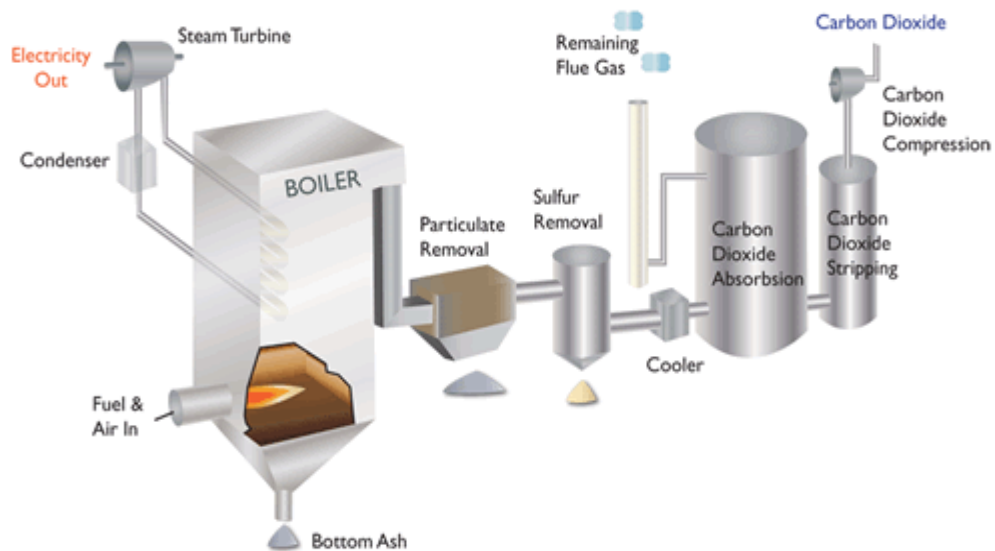
- Costs have **1)** slightly on the project. We will exceed the budget.
- The number of rejects **2)** dramatically. We will have to invest in new machines.
- Sales are finally beginning to **3)**. We should hit our target next quarter.
- Work should **4)** in the autumn. That's traditionally our best time.
- Sales **5)** by 10 percent in the past quarter. We need a new advertising campaign.
- Demand **6)** due to the hot weather. People use a great deal less electricity in summer.
- Costs are **7)** after steep increases. We expect them to start **8)** next quarter.
- Prices have **9)** a lot recently. We hope they will **10)** soon.

fell, stabilize, increased, falling, fluctuated, pick up, take off, leveling off, shot up, slumped

Task 11. Complete the sentences according to their sense.

1. Costs have **1)** steadily over the past year. That is due to higher transportation costs.
2. The dollar has **2)** slightly against the euro. We are back at last year's rate.
3. We are currently **3)** at a phenomenal rate. We expect to be bigger than our main competitors soon.
4. The popularity of our products continues to **4)**. They are becoming a must-have among young people.
5. Our market share has **5)** to less than 20 percent. We need new products.
6. Interest has **6)**. We need to regenerate it through new advertising.
7. Tourist numbers **7)** in August. We are usually full for the whole month.
8. We think prices have **8)**. We expect to see a small increase soon.

Task 12. Prepare a short presentation on “Major Components of a Coal-Fired Power Plant with Carbon Capture”.



UNIT 6. URANIUM (NUCLEAR) POWER PRODUCTION

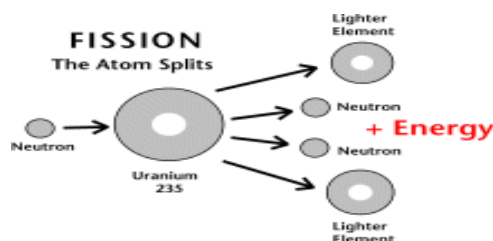
Learning outcomes

- Discussing the process of nuclear fission
- Determining the main stages of nuclear power production
- Improving the skills of rendering pictures into text information

Starting point

1. *What do you remember from the course of chemistry about the atom structure?*
2. *What are the main advantages of nuclear power?*
3. *Do you agree that nuclear power plants pose considerable threat to the environment and the safety of population?*

Task 1. *Comment on how fission splits the uranium atom.*



Task 2. *Insert the words into the appropriate blanks in the text. Mind there are three irrelevant words.*

Nuclear energy is energy in the nucleus 1) ... of an atom. Atoms are tiny 2) ... that make up every object in the 3) There is enormous energy in the 4) ... that hold atoms together. Nuclear energy used to make electricity must be released first either by nuclear fission or by nuclear fusion. In nuclear 5) ..., atoms are split apart to form smaller atoms, releasing energy. Nuclear 6) ... plants use this energy to produce electricity. In nuclear 7) ..., energy is released when atoms are combined to form a larger atom. This is how the 8) ... produces energy. Fusion is

the subject of ongoing **9)** ..., but it is not yet clear that it will ever be a commercially **10)** ... technology for electricity generation.

*bonds, core, fixture, fission, fusion, particles, parts, power, research, sun,
universe, viable, viability*

Task 3. Restore the words in the text “Nuclear Power Comes from Fission”.

The **f...** most widely used by nuclear plants for nuclear fission is uranium. Uranium is **no...e**, though it is a common metal found in **ro..s** all over the world. Nuclear **p...s** use a certain kind of uranium, referred to as U-235. This kind of uranium is used as fuel because its atoms are easily **s...** apart. Though uranium is quite common, about 100 times more common than silver, U-235 is **re...ly** rare. During nuclear **f...n**, a small particle called a neutron hits the uranium atom and splits it, releasing a great amount of energy as **h...** and radiation. Released neutrons go on bombarding other uranium atoms, and the process **r...s** itself over and over again as a **c...** reaction.

Task 4. Match the sentence parts.

1. Most power plants, including nuclear plants, ...	a. a separate power plant structure called a cooling tower.
2. They rely on steam from heated water to spin ...	b. each one producing roughly the same amount of energy as 150 gallons of oil.
3. Instead of burning fossil fuels to produce the steam,	c. large turbines, which generate electricity.
4. In nuclear fission, atoms are split apart ...	d. metal fuel rods forming fuel assemblies.
5. Fission takes place inside ...	e. nuclear plants use heat given off during fission.
6. At the center of the reactor is ...	f. the core, which contains the uranium fuel.
7. The uranium fuel is formed into ceramic pellets, ...	g. the reactor of a nuclear power plant.
8. These energy-rich pellets are stacked in ...	h. to boil water into steam turning the turbine blades that drive generators to make electricity.
9. The heat given off during fission in the reactor core is used ...	i. to form smaller atoms, releasing energy.
10. Afterward, the steam is cooled back into water in ...	j. use heat to produce electricity.

Task 5. Basing on tasks 3 and 4 discuss in pairs the following issues:

- the difference between fusion and fission;
- the energy value of nuclear fuel as compared with gasoline;
- the possible dangers of nuclear reactors.

Task 6. Render the text in English.

В мире построено и работают множество атомных электростанций (АЭС). Однако сегодня АЭС уже не считаются источником дешевой и экологически чистой энергией. Топливом для АЭС служит урановая руда – дорогостоящее и трудно добываемое сырье, запасы которого ограничены. К тому же строительство и эксплуатация АЭС сопряжены с большими трудностями и затратами. Серьезным тормозом для дальнейшего развития атомной энергетики являются проблемы загрязнения окружающей среды. Все это дополнительно осложняет отношение к атомной энергетике. Все чаще звучат призывы использовать так называемые малые или «нетрадиционные» виды получения энергии. К последним относят установки и устройства, использующие энергию ветра, воды, солнца, геотермальную энергию, а также тепло, содержащееся в воде, воздухе и земле.

Task 7. Find synonyms to each adjective in the table describing the amount and intensity of an increase.

When talk about changes, we often need to point out how big or rapid these changes have been. To do this, we need to use adjectives.

INCREASE			
<i>Big</i>	<i>Small</i>	<i>Fast</i>	<i>Slow</i>

steady, slight, considerable, sudden, substantial, moderate, spectacular, enormous, rapid, gradual, marginal, sharp

Task 8. Match the sentence parts.

1. Demand fell by over 40% which is ...	a. a marginal increase in real terms.
2. Sales grew by 40% which is ...	b. a sharp drop in demand.
3. There was a slight increase in days lost due to strikes, ...	c. a substantial drop
4. Losses due to breakage fell marginally, ...	d. an enormous increase in one year.
5. Transport costs rose by 1 %, ...	e. every month over the last year.
6. The sudden change in weather means we have seen ...	f. just a slight fall of 0.2%.
7. There has been a sudden increase in demand, ...	g. only a couple more than last year.
8. We have seen a gradual increase of 2-3 % ...	h. productivity has risen over the past 3 months.
9. There has been a steady fall in costs as ...	i. since the announcement only days ago.

Task 9. Insert the correct prepositions.

1. The sharp change in weather means we have seen a sharp drop **1)** demand.
2. Sales grew **2)** one million copies which is an enormous increase **3)** one year.
3. The costs of breakages fell marginally, just a slight fall **4)** only 0.2%.
4. There has been a steady fall **5)** costs as productivity has risen **6)** the past six months.
5. There has been a sudden increase **7)** demand, since the yesterday's announcement.
6. There was a slight increase **8)** staff turnover, only a couple more people as compared with last year.
7. Absenteeism fell **9)** over 40 % which is a substantial drop.
8. Transport costs rose **10)** 1 %, which is a marginal increase in real terms.
9. We have seen a gradual increase **11)** 2-3% every month **12)** the last year.

Task 10. Look through the given information and prepare a short presentation on the types of nuclear reactors.

Nuclear reactors are large machines that contain and control nuclear chain reactions, while releasing heat at a controlled rate. A nuclear power plant uses the

heat supplied by the nuclear reactor to turn water into steam, which drives turbine-generators that generate electricity.

Boiling-Water Reactors - the water heated by the reactor core turns directly into steam in the reactor vessel and is then used to power the turbine-generator.

Pressurized-Water Reactors - the water heated by the reactor core is kept under pressure so that it does not turn to steam at all and remains liquid. This hot radioactive water flows through a piece of equipment called a steam generator.

A steam generator is a giant cylinder with thousands of tubes in it that the hot radioactive water can flow through and heat up. Outside these hot tubes in the steam generator is nonradioactive water (or clean water), which eventually boils and turns to steam. The radioactive water flows back to the reactor core, where it is reheated and then sent back to the steam generator. The clean water may come from one of several sources including oceans, lakes, or rivers.

Diagram of a Boiling Water Nuclear Reactor

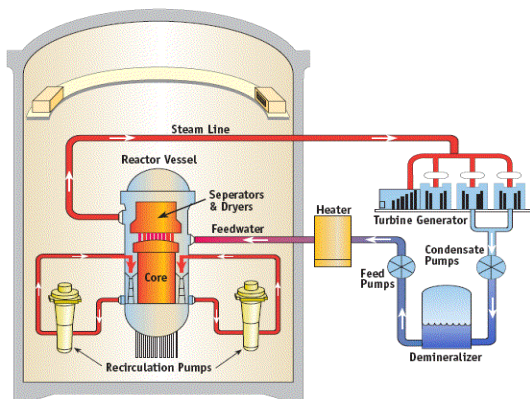
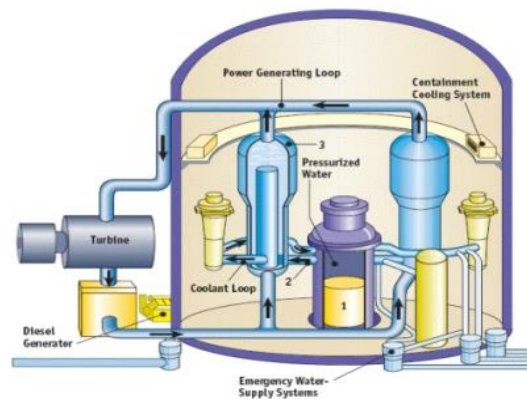


Diagram of a Pressurized Nuclear Reactor System



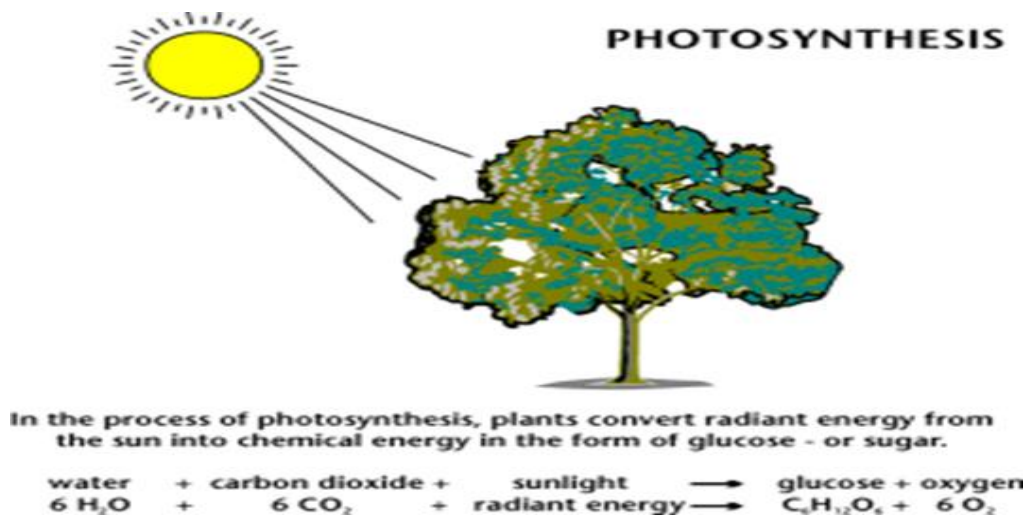
UNIT 7. BIOMASS AS AN ENERGY SOURCE

Learning outcomes

- Discussing the origin of biomass and its different sources
- Outlining a general scheme of a landfill construction and operation
- Mastering the skills of rendering pictures into text information

Starting point

1. *What do you remember from the course of biology about biomass?*
2. *Can biomass be considered an environment friendly source of power?*
3. *Comment on the process of photosynthesis that is depicted below.*



Task 1. Insert the words into the blanks. There are three irrelevant words.

Biomass is **1)** material made from plants and animals (microorganisms). Biomass contains **2)** energy from the sun. Plants **3)** the sun's energy in a process called photosynthesis. The **4)** energy in plants gets passed on to animals and people that eat them. Biomass is a **5)** energy source because we can always grow more trees and crops, and waste will always exist. Some examples of biomass fuels are wood, crops, **6)**, and some garbage. When burned, the chemical energy in biomass is released as **7)**. Burning biomass is not the only way to **8)** its energy. Biomass can be

converted to other **9)** forms of energy, such as methane gas or transportation **10)**, such as ethanol and biodiesel.

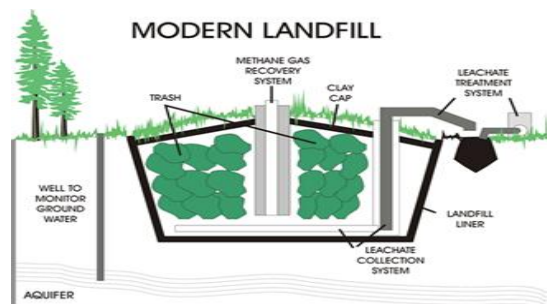
Methane gas is the main **11)** of natural gas. Smelly stuff - rotting garbage, agricultural and human **12)**, release methane gas also called "landfill gas" or "biogas". Crops like corn and sugar cane can be **13)** to produce ethanol. Biodiesel, another **14)** fuel, can be produced from left-over **15)** products like vegetable oils and animal fats.

absorb, chemical, fermented, fast, food, fuels, heat, ingredient, manure, most, organic, release, renewable, stored, transportation, useable, using, waste

Task 2. Guess the missing words.

Garbage is often called municipal solid **1)** (MSW), it contains biomass (or biogenic) materials like paper, cardboard, food scraps, grass clippings, leaves, wood, and leather products, and other non-biomass combustible **2)**, mainly plastics and other synthetic materials made from petroleum. Today, we can **3)** garbage in special waste-to-energy plants and use its **4)** energy to make steam to **5)** buildings or to generate electricity. Many large landfills also generate electricity with the methane gas that is produced as **6)** decomposes in the landfills. But providing electricity is not the major **7)** of waste-to-energy plants that generate electricity. It actually **8)** more to generate electricity at a waste-to-energy **9)** than it does at a coal, nuclear, or hydropower plant. The major advantage of **10)** waste is that it reduces the amount of garbage we bury in landfills.

Task 3. Get ready to discuss the landfill structure and operation.



Landfills can be a source of energy. Anaerobic bacteria that live in landfills decompose organic waste to produce a gas called biogas that contains methane. Methane is the same energy-rich gas that is in natural gas, which is the fuel used for heating, cooking, and producing electricity. Methane is colorless and odorless, and a very strong greenhouse gas. Natural gas utilities add an odorant so people can detect natural gas leaks from pipelines. Landfill biogas can also be dangerous to people or the environment.

Some landfills simply burn the methane gas in a controlled way to get rid of it. But the methane can also be used as an energy source. Landfills can collect the methane gas, treat it, and then sell it as a commercial fuel. It can then be burned to generate steam and electricity.

Some farmers produce biogas in large tanks called "digesters" where they put manure and bedding material from their barns. Some cover their manure ponds to capture biogas. Biogas digesters and manure ponds contain the same anaerobic bacteria in landfills. The biogas can be used to generate electricity or heat for use on the farm.

Task 4. Basing on the English source text render the Russian text

"Biofuels" are transportation fuels like ethanol and biodiesel that are made from biomass materials. These fuels are usually blended with the petroleum fuels — gasoline and diesel fuel, but they can also be used on their own. Using ethanol or biodiesel means we don't burn quite as much fossil fuel. Ethanol and biodiesel are usually more expensive than the fossil fuels that they replace, but they are also cleaner-burning fuels, producing fewer air pollutants.

Biodiesel is a fuel made from vegetable oils, animal fats, or greases. Biodiesel fuel can be used in diesel engines without changing them. Biodiesel, a renewable fuel, is safe, biodegradable, and produces lower levels of most air pollutants than petroleum-based products. About half of biodiesel producers are able to make biodiesel from used oils or fats, including recycled restaurant grease.

Ethanol is a clear, colorless alcohol fuel made from the sugars found in grains, such as corn, sorghum, and barley, as well as potato skins, rice, sugar cane, sugar beets, and yard clippings. Ethanol is a renewable fuel because it is made from plants. Ethanol can also be produced by breaking down cellulose in woody fibers. Cellulosic ethanol is considered an “advanced” biofuel and involves a more complicated production process than conventional ethanol made from starches or sugars. However, with this process we can make ethanol from trees, grasses, and crop wastes, reducing concerns that increasing ethanol production will reduce food supply.

Trees and grasses are potential feedstocks for cellulosic ethanol production. They require less energy, fertilizers, and water than grains and can also be grown on lands that are not suitable for growing food. Scientists have developed fast-growing trees that grow to size in 10 years. Many grasses can produce two harvests a year for many years without a need for annual replanting. Someday, you may find yourself driving by huge farms that are not producing food or animal feed, but feedstock for ethanol.

Такие виды биотоплива на основе биомассы, как этанол и биодизель, могут использоваться в качестве топлива для транспортных средств как самостоятельно, так и в виде смеси в определенной пропорции с бензином или дизельным топливом. С одной стороны, этанол и биодизель гораздо дороже, чем традиционные виды топлива на основе полезных ископаемых, но, с другой стороны, они являются менее токсичными при сгорании и выделяют меньше загрязняющих веществ в атмосферу.

Биодизель – это возобновляемый, безопасный и биологически перерабатываемый вид топлива, получаемый сегодня из растительных масел, животных жиров и даже отходов предприятий общественного питания. Такое топливо может использоваться и в обычных дизельных двигателях без изменения их конструкции.

Этанол представляет собой спирто-бензиновое моторное топливо, не имеющее цвета и получаемое из зерновых культур, а также картофельной

кожур, риса, сахарного тростника, сахарной свеклы и даже подстилочных материалов. Он относится к возобновляемым видам топлива на растительной основе. Усовершенствованным видом биотоплива является «целлюлозный» этанол, получаемый путем расщепления целлюлозы древесины. Расширенное применение данной технологии позволит получать биотопливо на основе древесной и травяной массы, отходов растениеводства, тем самым снижая риск сокращения производства пищевой продукции в пользу увеличения производства биотоплива. Деревья и травы являются превосходным промышленным сырьем для производства этанола - им требуется меньше энергии, удобрений и воды по сравнению с зерновыми культурами, а также они могут произрастать на различных почвах, не требующих специальной подготовки. К тому же покос многих трав возможен дважды в год.

Task 5. Complete the table by separating environmental pros and cons of switching to plant-based “biofuels” in the USA.

ECO-BENEFITS	PROBLEMS

1. Ethanol and biodiesel emit less particulate pollution than traditional petroleum-based gasoline and diesel fuels.
2. Producing biofuels actually requires more energy than they can generate. Producing ethanol from corn requires 29 percent more energy than the end product itself is capable of generating. Similarly troubling numbers have been found in making biodiesel from soybeans.
3. Replacing only 5 percent of the US diesel consumption with biodiesel would require diverting approximately 60 percent of today’s soy crops to biodiesel production.
4. Since such fuels are derived from agricultural crops, they are inherently renewable and our own farmers typically produce them domestically, reducing our dependence on unstable foreign sources of oil.

5. The challenge of growing enough crops to meet demand, something skeptics say might well require converting just about all of the world's remaining forests and open spaces over to agricultural land.
6. They do not contribute to global warming, since they only emit back to the environment the carbon dioxide (CO₂) that their source plants absorbed out of the atmosphere in the first place.
7. Unlike other forms of renewable energy (like hydrogen, solar or wind), biofuels are easy for people and businesses to transition to without special apparatus or a change in vehicle or home heating infrastructure—you can just fill your existing car, truck or home oil tank with it.
8. Wholesale societal shift from gasoline to biofuels, given the number of gas-only cars already on the road and the lack of ethanol or biodiesel pumps at existing filling stations, would take some time.

Task 6. Reorganize the text to get complete descriptions of the figures.

When talk about changes, we often show graphs. We don't need to give precise figures but we do need to comment on them, interpret them and point out relevant facts. Let's look at some language to do this.

1. soar over the next five years. Sales finished ...	a. under nine million.
2. see from this graph showing smoother sales, despite slight ...	b. Our overall ...
3. Let's look at the ...	c. performance is good with total sales in the ...
4. fluctuations, there is strong upward ...	d. three percent to just ...
5. year.	e. roughly ten percent of our business. However, there is a slight downward ...
6. figures more closely. As you can ...	f. surge in online sales. In fact, they now represent ...
7. increase on the previous financial ...	g. trend in retail outlet sales. Here we saw a drop of about ...
8. trend and we predict that sales will ...	h. start, we are now seeing a ...
9. going up at approximately ten million which is substantial ...	i. region of ten million. After a rather slow ...

Task 7. Complete the text.

Our **1)** performance is good with total sales in the **2)** of ten million. After a rather **3)** start, we are now seeing a **4)** in online sales. In fact, they now represent **5)** ten percent of our business. However, there is a slight **6)** trend in retail outlet sales. Here we saw a **7)** of **8)** three percent to **9)** to nine million.

Let's look at the **10)** more closely. As you can see from this **11)** showing smoother sales, despite **12)** fluctuations, there is a strong upward **13)** and we predict the sales will **14)** over the next five years. Sales finished **15)** at **16)** ten million which is a **17)** increase on the **18)** financial year.

Task 8. Mini-group activity "Scientific conference".

Discuss the texts in mini-groups, then prepare for consecutive oral translation (one student will act as a reporter, another – as an interpreter). After the report, a debate session will be held (the questions from the audience will be translated into English and the reporter's answers – into Russian).

TEXT 1

Biomass & the Environment

Using biomass for energy can have both positive and negative impacts on the environment. Burning biomass may result in more or less air pollution depending on the type of biomass and fuels or energy sources replaced by it. Biomass like lumber mill sawdust, paper mill sludge, yard waste in household trash used for energy may avoid the use of fossil fuels such as coal or natural gas. Burning fossil fuels and biomass releases carbon dioxide (CO₂), a greenhouse gas, but when the plants that are the sources of biomass are grown, a nearly equivalent amount of CO₂ is captured through photosynthesis. Sustainable cultivation and harvesting of biomass can result in no net increase in CO₂ emissions.

Using wood, and charcoal made from wood, for heating and cooking can replace fossil fuels and may result in lower CO₂ emissions. Wood may be harvested from forests or woodlots that have to be thinned or come from urban

trees that fall down or have to be cut down anyway. However, wood smoke contains harmful pollutants like carbon monoxide and particulate matter. Burning wood in an open fireplace is very inefficient and produces lots of air pollution. Wood and charcoal are major cooking and heating fuels in poor countries, and the wood may be harvested faster than trees can grow. This results in deforestation. Planting fast-growing trees for fuel and using fuel-efficient cooking stoves can help slow deforestation and improve the environment.

Burning municipal solid waste and wood waste to produce energy means that less of it has to get buried in landfills. Like plants that burn coal, waste-to-energy plants produce air pollution when the fuel is burned to produce steam or electricity. Burning garbage releases the chemicals and substances found in the waste. Some of these chemicals can be dangerous to people, the environment, or both, if they are not properly controlled.

Incinerators and waste-to-energy power plants must use technology to prevent harmful gases and particles from coming out of their smoke stacks. Plants that burn waste to make electricity must use technology to prevent harmful gases and particles from coming out of their smoke stacks. A waste-to-energy furnace burns at such high temperatures (1,800 to 2,000°F) that many complex chemicals naturally break down into simpler, less harmful compounds. This chemical change is a kind of built-in anti-pollution device.

TEXT 2

Biogas is a gas composed mainly of methane and carbon dioxide that forms as a result of biological processes in sewage treatment plants, waste landfills, and livestock manure management systems. Methane is one of the greenhouse gases associated with global climate change. Many of these facilities capture and burn the biogas for heat or electricity generation. Burning methane is actually beneficial because methane is a stronger greenhouse gas than CO₂. The electricity may replace electricity produced by burning fossil fuels and result in a net reduction in CO₂ emissions.

Ethanol and biodiesel were the fuels used in the first automobile and diesel engines, but lower cost gasoline and diesel fuel made from crude oil became the dominant vehicle fuels. Biofuels may be considered to be carbon-neutral because the plants that are used to make biofuels (such as corn and sugarcane for ethanol, and soy beans and palm oil trees for biodiesel) absorb CO₂ as they grow and may offset the CO₂ produced when biofuels are made and burned.

Growing plants for biofuels is controversial however, as the land, fertilizers, and energy used to grow biofuel crops could be used to grow food crops instead. Also, in some parts of the world, large areas of natural vegetation and forests have been cut down to grow sugar cane for ethanol and soybeans and palm-oil trees to make biodiesel. Governments are supporting efforts to develop alternative sources of biomass that do not compete with food crops and use less fertilizer and pesticides than corn and sugar cane, and methods to produce ethanol that require much less energy than conventional fermentation. Ethanol may also be made from waste paper, and biodiesel can be made from waste grease and oils and even algae.

Ethanol and ethanol-gasoline mixtures burn cleaner and have higher octane than pure gasoline, but have higher "evaporative emissions" from fuel tanks and dispensing equipment. These evaporative emissions contribute to the formation of harmful ground-level ozone and smog. Gasoline requires extra processing to reduce evaporative emissions before it is blended with ethanol. As compared to petroleum diesel, biodiesel combustion produces less sulfur oxides, particulate matter, CO, and unburned and other hydrocarbons, but more nitrogen oxide.

TEXT 3

Ethanol & the Environment

Unlike gasoline, pure ethanol is nontoxic and biodegradable; it quickly breaks down into harmless substances if spilled. However, chemical denaturants are added to fuel ethanol (in relatively small quantities) to make it undrinkable. Many of the denaturants that are used are toxic. Similar to gasoline, ethanol is a highly flammable liquid and must be transported carefully.

Ethanol and ethanol-gasoline mixtures burn cleaner and have higher octane than pure gasoline, but have higher "evaporative emissions" from fuel tanks and dispensing equipment. These evaporative emissions contribute to the formation of harmful, ground-level ozone and smog. Gasoline requires extra processing to reduce evaporative emissions before it is blended with ethanol.

Ethanol may be considered to be carbon-neutral because the plants that are used to make fuel ethanol (such as corn and sugarcane) absorb CO₂ as they grow and may offset the CO₂ produced when ethanol is made and burned. In the U.S., coal and natural gas are used as the heat sources in the fermentation process to make fuel ethanol. The impact of greater ethanol use on net carbon dioxide emissions depends on how ethanol is made and on whether or not indirect impacts on land use are included in the calculations. Also, growing plants for fuel is controversial, as the land, fertilizers, and energy used to grow biofuel crops could be used to grow food crops instead.

TEXT 4

Biodiesel & the Environment

Biodiesel is nontoxic and biodegradable. Compared to diesel fuel made from petroleum, biodiesel produces fewer air pollutants like particulates, carbon monoxide, sulfur dioxide, hydrocarbons, and air toxics. However, it does slightly increase emissions of nitrogen oxides.

Biodiesel may be considered to be carbon-neutral because the plants that are used to make it, such as soy beans and palm oil trees, absorb carbon dioxide (CO₂) as they grow and may offset the CO₂ produced when biodiesel is made and burned. However, in some parts of the world, large areas of natural vegetation and forests have been cleared and burned to grow soybeans and palm oil trees to make biodiesel. The negative environmental impacts of these activities are probably much greater than any potential benefits from using the biodiesel produced from the plants grown to make biodiesel.

UNIT 8. HYDROPOWER ENGINEERING

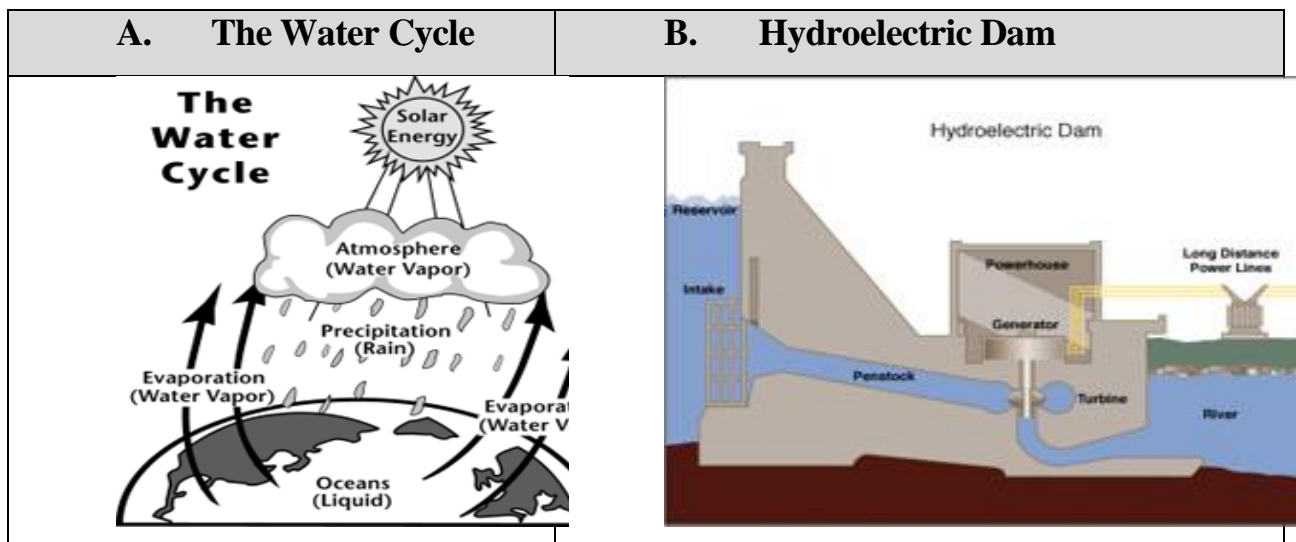
Learning outcomes

- Discussing a hydropower plant design and hydropower production stages
- Determining the distinctive features of tidal and wave power stations
- Mastering the skills of rendering pictures into text information

Starting point

1. *What do you remember from the course of biology and geography about natural water cycle?*
2. *Do you agree that hydropower station may pose considerable danger to the environment?*
3. *What are the main disadvantages of hydropower production?*

Task 1. Use the information given below to describe the graphs.



- In a run-of-the-river system, the current force applies the needed pressure.
- In a storage system, water is accumulated in reservoirs created by dams, then released as needed to generate electricity.
- In either instance, the water flows through a pipe, or *penstock*, then pushes against and turns blades in a turbine to spin a generator to produce electricity.
- Solar energy heats water on the surface, causing it to evaporate.

- Swiftly flowing water in a big river carries a great deal of energy in its flow.
- The available energy amount in moving water is determined by its flow or fall.
- The water flows through rivers back into the oceans, where it can evaporate and begin the cycle over again.
- This water vapor condenses into clouds and falls back onto the surface as precipitation (rain, snow, etc.).
- Understanding the water cycle is important to understanding hydropower. In the water cycle:
- Water descending rapidly from a very high point also has lots of energy in its flow.

Task 2. Insert the words into the blanks of the text “Hydropower & the Environment”. Mind that there are three irrelevant words.

While hydropower (hydro-electric) generators do not directly produce **1)** of air pollutants, hydropower dams, reservoirs, and the operation of generators can have **2)** impacts. A dam to create a reservoir may **3)** migration of fish to their **4)** spawning areas. A reservoir and operation of the dam can also change the natural water **5)**, chemistry, **6)** characteristics, and silt loads, all of which can lead to significant **7)** in the ecology (living organisms and the environment) and rocks and land forms of the river upstream and **8)**. These changes may have **9)** impacts on native plants and animals in and next to the river, and in the deltas that form where rivers **10)** into the ocean. Reservoirs may cover important **11)** areas, agricultural land, and archeological sites, and cause the **12)** of people. Greenhouse gases, **13)** dioxide and methane, may also form in reservoirs and be **14)** to the atmosphere. Hydro turbines kill and **15)** some of the fish that pass through the turbine.

carbon, changes, changing, downstream, emissions, emitted, empty, environmental, flow, injure, natural, nature, negative, obstruct, all, relocation, temperatures, upstream

Task 3. Analyze the meaning of the words in a bold type and translate the text “Tidal and Wave Power”.

Tides are caused by the **gravitational pull** of the moon and sun, and the rotation of the Earth. Tidal power is more predictable than wind energy and solar power. A large enough **tidal range** of 10 feet is needed to produce tidal energy economically. A simple generation system for tidal plants involves a **dam**, known as a **barrage**, across an **inlet**. **Sluice gates** (commonly used to control water levels and flow rates) on the barrage allow the **tidal basin** to fill on the **incoming high tides** and to empty through the turbine system on the **outgoing tide**, also known as the **ebb tide**. There are two-way systems that generate electricity on both the incoming and outgoing tides. A potential disadvantage of tidal power is the effect a tidal station can have on plants and animals in the **estuaries**. Tidal barrages can change the tidal level in the basin and increase **turbidity** (the amount of matter in suspension in the water). They can also affect navigation and recreation.

Tidal fences can also harness the energy of tides. A tidal fence has vertical axis turbines mounted in a fence. All the water that passes is forced through the turbines. Tidal fences can be used in areas such as channels between two **landmasses**. Tidal fences are cheaper to install than tidal barrages and have less impact on the environment than tidal barrages, although they can disrupt the movement of large marine animals.

Tidal turbines are basically wind turbines in the water that can be located anywhere there is strong tidal flow. Because water is about 800 times denser than air, tidal turbines have to be much **sturdier** than wind turbines. Tidal turbines are heavier and more expensive to build but capture more energy.

Waves are caused by the wind blowing over the ocean surface. There is tremendous energy in the ocean waves. One way to harness wave energy is to bend or focus the waves into a narrow channel, increasing their power and size. The waves can then be channeled into a **catch basin** or used directly to **spin** turbines.

Task 4. Render the text in English.

Энергетические ресурсы океана представляют большую ценность как возобновляемые и практически неисчерпаемые. Уровень воды на морских побережьях в течение суток меняется три раза. Для устройства простейшей приливной электростанции (ПЭС) нужен бассейн – перекрытый плотиной залив или устье реки. В плотине имеются водопропускные отверстия и установлены турбины. Во время прилива вода поступает в бассейн. Когда уровни воды в бассейне и море сравниваются, затворы водопропускных отверстий закрываются. С наступлением отлива уровень воды в море понижается, и, когда напор становится достаточным, турбины и соединенные с ним электрогенераторы начинают работать, а вода из бассейна постепенно уходит. Считается экономически целесообразным строительство ПЭС в районах с приливными колебаниями уровня моря не менее 4 м.

В приливных электростанциях двустороннего действия турбины работают при движении воды из моря в бассейн и обратно. ПЭС двустороннего действия способна вырабатывать электроэнергию непрерывно в течение 4-5 ч с перерывами в 1-2 ч четыре раза в сутки.

С точки зрения экологии ПЭС имеет бесспорное преимущество перед тепловыми электростанциями, сжигающими нефть и каменный уголь.

Task 5. Mix and match to make your presentation more persuasive by making your points stronger.

1. The launch was a total	a. competitive market. We need to cut our costs dramatically.
2. Sales in Asia have been extremely	b. good. Let's hope they will continue to do it.
3. Opting to relocate production was a terrible	c. better.
4. Although this product is much	d. disaster. We didn't get right at all.
5. We are one hundred percent	e. too expensive to print.
6. We are working in a highly	f. certain that this is the best solution.
7. A full colour brochure would be far	g. aware of the alternatives.
8. The initial tests are good, but I firmly believe we can do even	h. no chance of success unless we invest heavily.
9. We are all fully	i. cheaper, I wouldn't recommend it.
10. There is absolutely	j. mistake. We simply don't have the same level of quality.

Task 6. Mix and match.

1. Strongly	a. Refuse
2. Totally	b. Recommend
3. Openly	c. Believe
4. Firmly	d. Agree
5. Fully	e. Encourage
6. Positively	f. Deny
7. Categorically	g. Admit
8. Absolutely	h. Appreciate

Task 7. Complete the text with the words given below.

1. As you can see, it has been a **1)** disaster since the beginning. Nothing has been right at all.
2. The following month, the figures were **2)** better.
3. Bringing in outside consultants would be **3)** too expensive at this point.
4. I am **4)** certain that we can succeed.
5. If we analyze the figures, we can see that there is **5)** no chance of our making even a small profit.
6. This is a **6)** competitive field where margins are extremely small. We need to cut our costs dramatically.
7. We are **7)** aware of the consequences of failure.
8. We have an **8)** good sales team who are now ready to take up the challenge.
9. We would be making a **9)** mistake if we didn't consider the alternatives.
10. What we need to do is to find a **10)** cheaper solution, and as quickly as possible.

Task 8. Mix and match.

1. We need a change in policy. I would strongly	a. encourage open discussion of policy.
2. You are absolutely right. I totally	b. admit that our strategy didn't work as well as we had hoped.
3. It did not work. We openly	c. believe in giving everyone the space to take initiatives.
4. We must give everyone a chance. I firmly	d. deny any negligence.
5. I have analyzed the figures carefully and I fully	e. refuse to accept that we can't significantly improve on these figures.

6. We want to hear your point of view. We positively	f. appreciate their significance.
7. We followed all safety procedures. We categorically	g. agree with everything you have said so far.
8. We can do better. I absolutely	h. recommend a radical change.

Task 9. Complete the text.

1. This is not the solution. I **1)** refuse to believe this will bring us the results we want.
2. Everyone is treated equally. We **2)** deny any discrimination.
3. This is a winning product. I **3)** believe we can be the market leader.
4. There were some mistakes made. I **4)** admit responsibility for them.
5. John has hit the nail on the head. I **5)** agree with what he is saying.
6. It has been on the market for five years. I would **6)** recommend updating it.
7. I have listened to the arguments and I **7)** appreciate your concerns.
8. Everyone can contribute to our success. We **8)** encourage suggestions for improvements from all levels.

absolutely, openly, totally, fully, positively, firmly, strongly, categorically

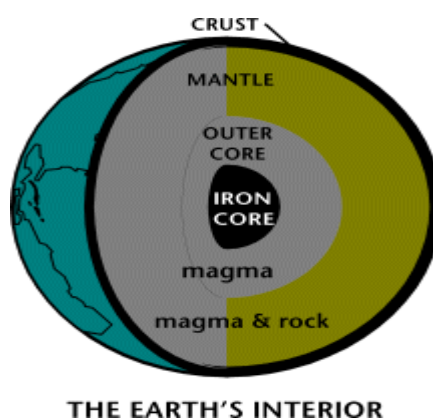
UNIT 9. GEOTHERMAL ENERGY

Learning outcomes

- Discussing the origin of geothermal water
- Determining prospective areas of using geothermal energy in farming
- Mastering the skills of rendering pictures into text information

Starting point

1. *What do you understand by the word “geothermal”? Refresh a course of geography.*
2. *Have you ever heard about the use of geothermal energy in agriculture? Where do you suppose it could be used?*
3. *Can you describe this picture in your own words?*



Task 1. Find the English equivalents to the following Russian words and expressions basing on the analysis of the offered text: происходит от, постоянно, недра земли, земная кора, слой породы, выходить на поверхность, бурение скважин.

What Is Geothermal Energy?

The word geothermal comes from the Greek words *geo* (earth) and *therme* (heat). So, geothermal energy is heat from within the Earth. Geothermal water is a renewable energy source because the heat is continuously produced in the Earth core.

Below Earth's crust, there is a layer of hot rock, called magma, which sometimes comes may quite close to the surface so that its heat can be transferred

to water, thus forming a usable form of geothermal energy. Heat is produced from naturally radioactive materials - uranium and potassium. It is hard to imagine that the amount of heat within Earth contains 50,000 times more energy than all the oil and natural gas resources in the world.

Natural areas of hydrothermal resources are called geothermal reservoirs. Geothermal energy sometimes finds its way to the surface in the form of:

- volcanoes and fumaroles (holes where volcanic gases are released)
- hot springs
- geysers

Geologists use various methods to look for geothermal reservoirs. Drilling a well and testing the temperature deep underground is the most reliable method for finding a geothermal reservoir.

Task 2. Insert the words into the text. There are three irrelevant words

Use of Geothermal Energy

People around the world use geothermal energy to 1) ... and cool their homes and to produce electricity by 2) ... deep wells and pumping the heated underground water or steam to the 3) Geothermal heat pumps are the most energy efficient, environmentally clean, and cost effective systems for temperature control. They use 4) ... ground or water temperatures near the Earth surface to control building temperatures above ground. The three main uses of geothermal energy are:

- Direct use and district 5) ... systems use hot water from springs or reservoirs near the surface. Ancient Romans, Chinese, and Native American cultures used hot mineral springs for bathing, cooking, and heating. Today, many hot springs are still used for bathing, and many people believe that mineral-rich waters hot have natural healing powers. Hot water near the Earth's surface can be piped directly into buildings and industries for heating 6)

- Electricity generation plants require water or steam at very high temperature (300° to 700°F). Geothermal 7) ... plants are generally built where geothermal 8) ... are located within a mile or two of the surface.

- Industrial applications of geothermal energy include food dehydration, gold mining, and 9) ... pasteurizing. Dehydration, or the 10) ... of vegetable and fruit products, is the most common industrial use of geothermal energy.

digging, drying, heat, heating, hot, milk, power, purposes, preserve, reservoirs, stable, state, surface

Task 3. Agriculture does utilize the geothermal energy for cost efficient and sustainable food production and processing. Almost half of all food produced is lost due to a lack of affordable energy for food processing. Find the four main areas of using geothermal energy in agriculture.

Application area	Examples and explanation
Plant growing in an open field	
Improving soil characteristics	
Plant growing in protected ground	
Controlling environment inside residential buildings	

- Greenhouses need a constant temperature which can be maintained by geothermal water. The constant warmth inside help plants grow faster. Heating techniques employed by farmers include plastic tubes, finned coils and pipes, as well as soil heaters. Depending on the required temperature, farmers combine the tools to help the crops reach maximum growth rate before being transferred in the open field. Now, there is no need to wait for seed germination. Farmers are able to grow crops which are not in season thus making their production even more profitable.
- Heat pumps transfer underground heat into buildings in winter and reverse the process in summer. But a geothermal exchange system is more than a traditional furnace or air conditioner. For one thing, most of the equipment is underground. A mixture of water and antifreeze circulates through a long plastic pipe buried in the ground absorbing heat and carrying it either into or out of the building. This system it doesn't have to manufacture heat as it is free, renewable, and readily available. The only energy this system needs is some electricity to pump the liquid through the pipes and deliver the conditioned air to the building.

- Open fields are common all over the world and places that are fortunate enough to have access to any geothermal source and greatly benefit from that. Geothermal water is used to keep temperatures steady and protect plants and crops from the cold weather. This is possible with irrigation pipes running under the soil and intended not only for heating but also for watering crops thus preventing crop damage or at least keeping it at a minimum.
- Water helps in killing fungi, pests and diseases. There are two ways on how farmers do it. The first one is letting the heat from the underground pipes warm the soil until the pests are dead. The second one is applying the steam directly above the soil covering it with plastic sheets to keep the heat inside. These methods really help prolong the growing season.

Task 4. Match the sentence parts.

1. The environmental impact of geothermal energy depends on ...	a. how it is being used.
2. Direct use and heating applications have almost no	b. is emitted by fossil fuel plants.
3. Geothermal power plants do not burn fuel to generate electricity, so ...	c. is naturally found in the steam and hot water.
4. They release less than 1% of the CO ₂ emissions ...	d. methods and technologies used to extract it are improved
5. Geothermal plants use scrubber systems to clean the air of hydrogen sulfide that ...	e. negative impact on the environment.
6. Geothermal plants emit 97% less acid rain-causing sulfur compounds than ...	f. of a fossil fuel plant.
7. After the steam and water from a geothermal reservoir have been used, ...	g. that of coal, oil and gas altogether.
8. So the total capacity of this energy is bigger than ...	h. their emission levels are very low.
9. However, geothermal energy can be made more widely available if ...	i. they are injected back into the Earth.

Task 5. Render the text in English.

Около 4% всех запасов воды сосредоточено под землей – в толщах горных пород. Воды, температура которых превышает 20° C, называют термальными (от греч. «терме» - «тепло», «жар»). Нагреваются они в результате радиоактивных процессов и химических реакций в недрах Земли.

В странах, где термальные воды подходят близко к поверхности, сооружают геотермальные электростанции (геоТЭС). Они преобразуют тепловую энергию подземных источников в электрическую.

Геотермальные станции устроены относительно просто, топливо бесплатное и себестоимость вырабатываемой энергии в несколько раз ниже.

При прямой схеме получения электроэнергии на геотермальной электростанции природный пар направляется по трубам в турбины, соединенные с электрогенераторами. Непрямая схема: до того, как пар попадает в турбины, его очищают от газов, вызывающих разрушение труб. Смешанная схема: неочищенный пар поступает в турбины, а затем из воды, образовавшейся в результате конденсации, удаляют не растворившееся в ней газы.

Отработавший в турбинах пар попадает в конденсатор, где охлаждается и превращается в воду. Горячую воду (120 °С) используют для теплоснабжения населенных пунктов, обогревают здания, теплицы, парники, бассейны.

Task 6. Study the following patterns. We have seen how to emphasize points but sometimes you want to soften the impact of what you are saying and give them less importance. Here are some ways to do that, compare:

- We made a **huge** loss. - We made a loss. - We made a **slight** loss.
- The situation has improved **enormously**. - The situation has improved. - The situation has improved **slightly**.
- It is always **incredibly** difficult to ... - It is difficult to ... - It is sometimes a **little** difficult to ...

We can soften the impact of negative idea by responding using a positive word with a negative verb form.

- The results are **disappointing**.
- The results certainly aren't very **encouraging**, I'm afraid.

Task 7. Mix and match.

1. Sales in the first quarter were a little ...	a. better.
2. The response has been fairly ...	b. errors.
3. We have paid a small ...	c. on target.
4. The negotiations were partially ...	d. high.
5. There have been occasional ...	e. successful.
6. We have found the costs rather too ...	f. right.
7. Construction is still more or less ...	g. problem with it.
8. Our analysis of the situation was not quite ...	h. good.

Task 8. Are the sentences correct or not?

1. The results slightly are disappointing. We haven't quite achieved our objectives.
2. Although we have had some minor problems with the set-up, we are more or less on schedule.
3. The second offer was a little better but still not what quite we were hoping to get.
4. We have gone over slightly budget due to the rather long delays we have had getting approval for sale in the US.
5. There has been a slightly increase in productivity since the introduction on the new working schedules.
6. We will have to wait a little longer before we can see the full impact.
7. We have had slight improvement in our stock control. We have more and less ironed out the minor problems we were having with the new IT system.
8. The feedback was generally good but did highlight some areas where we can improve.
9. We have more or less finished the first series of testing but are not ready quite to move onto the second.

Task 9. Mix and match.

1. It was a bad idea.	a. It wasn't a good idea, and we can't pretend it was.
2. Demand is falling.	b. Demand isn't increasing, I'm sorry to say.
3. It's very difficult to resolve.	c. It won't be easy to resolve, that's for sure.
4. Results are disappointing.	

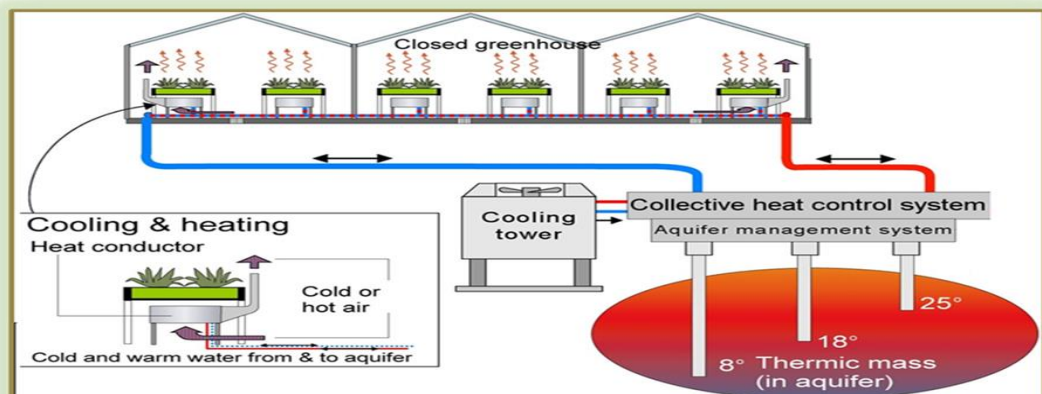
5. It was very inefficient.	d. Results aren't very encouraging. I'm afraid.
6. The feedback from the tests was negative.	e. It wasn't very efficient, that's obvious.
7. It was a very expensive solution.	f. The test feedback wasn't very positive, I'm sorry to say.
8. The figures are wrong.	g. It wasn't the cheapest solution, I have to agree.
9. It was a disaster.	h. The figures aren't exactly correct, I'm afraid.
10. The project was badly managed.	i. It certainly wasn't an unqualified success, that's obvious.
	j. Unfortunately, the project wasn't very well managed.

Task 10. Complete the sentences with the words given below.

1. It wasn't a **1)** idea, and we can't pretend it was.
2. Demand isn't **2)**, I am sorry to say.
3. It won't be **3)** to resolve, that's for sure.
4. Results aren't very **4)**, I'm afraid.
5. It wasn't very **5)**, that's obvious.
6. The feedback from the tests wasn't **6)**, I'm sorry to say.
7. It wasn't the **7)** solution, I have to agree.
8. The figures aren't exactly **8)**, I'm afraid.
9. It certainly wasn't an unqualified **9)**, that's obvious.
10. Unfortunately, the project wasn't **10)** managed.

cheapest, success, increasing, efficient, encouraging, very positive, correct, very good, easy, very well

Task 11. Basing on the facts from the previous tasks, describe the diagram.



UNIT 10. ELECTRICITY GENERATION FROM WIND

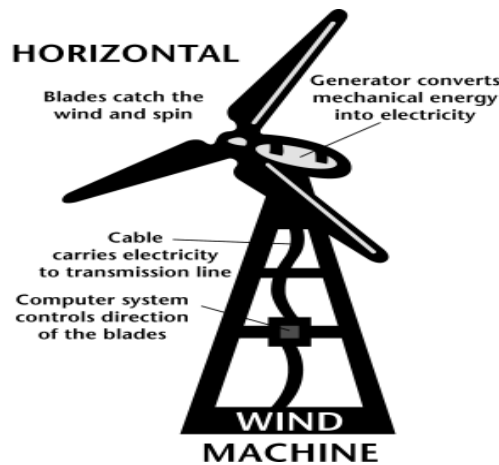
Learning outcomes

- Describing the ways and machines of wind power production
- Discussing the prospects of wind power engineering
- Mastering the skills of rendering pictures into text information

Starting point

1. *What can you say about the operating principle of a wind power plant?*

Use the picture to help you form the plot of your speech.

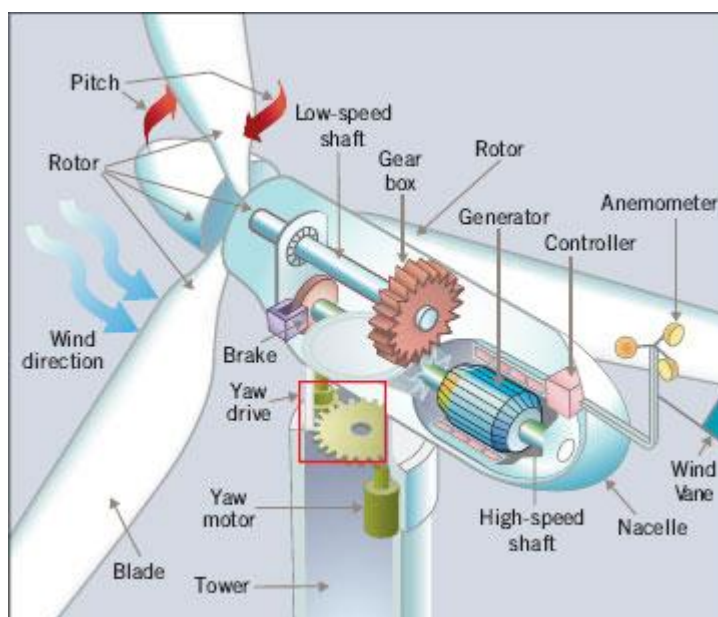


2. *Do you agree that wind power plants are feasible in Russia?*

Task 1. Try the guess the marked words basing on the context.

Wind is a renewable energy source that does not *pollute*, so some people see it as a good alternative to fossil fuels. Like old fashioned *windmills*, today's wind machines (also called *wind turbines*) use *blades* to collect the wind's kinetic energy. The wind flows over the blades creating *lift*, like the effect on airplane *wings*, which causes them to turn. The blades are connected to a *drive shaft* that turns an electric generator to produce electricity.

Task 2. Use the dictionary to find the right Russian variants for the parts of a wind power plant.



Task 3. Restore the incomplete words.

There are two types of wind machines (**t...s**) used today, based on the direction of the **r...g** shaft (axis): horizontal-axis wind machines and vertical-axis wind machines. The **s...e** of wind machines varies widely. Small turbines used to power a single home or business may have a **c...ity** of less than 100 kilowatts. Some **l...e** commercial-sized turbines may have a **c...ity** of 5 megawatts. Larger turbines are often **gr...ed** together into wind farms that provide power to the electrical grid.

Task 4. Divide the sentences offered below into two groups according to the proper type of turbines.

Horizontal-axis turbines	Vertical-axis turbines

1. Horizontal-axis wind machines have blades like airplane propellers. A typical machine stands as tall as a 20-storey building and has three blades that span 200 feet across.

2. Most wind machines being used today are of this type.
3. The machines stand tall and wide to capture more wind.
4. The most common type — the Darrieus wind turbine, named after the French engineer Georges Darrieus who patented the design in 1931 — looks like a giant, two-bladed egg beater.
5. These machines make up only a very small share of the wind machines used today.
6. Wind machines of this type have blades that go from top to bottom.

Task 5. Insert the missing words from those given below. Mind that there are three irrelevant words.

Wind is a **1)** source of energy, and overall, the use of wind for energy has fewer environmental **2)** than using many other energy sources. Wind turbines (often called windmills) do not release **3)** that pollute the air or water (with rare exceptions), and they do not require water for cooling. They may also reduce the **4)** of electricity generated from **5)** fuels and therefore reduce the amount of air **6)**, carbon dioxide emissions, and water use of fossil fuel power plants.

Wind turbines do have negative impacts on the **7)**, but these impacts have to be **8)** with our need for electricity and the overall lower environmental impact of using wind for energy **9)** to other sources of energy to **10)** electricity.

amount, balanced, clean, clearing, emissions, environment, fossil, fuel, impacts, make, pollution, relative, relationship

Task 6. Match the sentence parts.

1. Modern wind turbines are very large machines, and some people do not like ...	a. bird and bat deaths.
2. A few wind turbines have caught on fire, and some have leaked lubricating fluids, ...	b. declines in species that are also being affected by other human-related impacts.
3. Especially unpleasant for many people is ...	c. service roads that add to their physical impact on the environment.
4. Some types of wind turbines and wind projects cause ...	d. the equivalent amount of energy used to make and install them.
5. These deaths may contribute to ...	e. the sound that wind turbine blades
6. Most wind power projects on land also	

require ...	make.
7. Using the metals in wind turbines and concrete for their foundations requires ...	f. the use of energy, which may be from fossil fuels.
8. Also wind turbines produce much more clean electricity over their operating life than ...	g. their visual impact on the landscape. h. though this is relatively rare.

Task 7. Render the text in English.

Энергия ветра очень велика. Эту энергию можно получать, не загрязняя окружающую среду. Но у ветра есть два существенных недостатка: его энергия сильно рассеяна в пространстве и он непредсказуем – часто меняет направление, внезапно затихает, а иногда достигает невероятной силы.

Строительство, содержание, ремонт ветроустановок, работающих в любую погоду под открытым небом, стоит недешево. Ветроэлектростанция такой же мощности, как ГЭС, ТЭЦ или АЭС, по сравнению с ними занимает большую площадь. Ветроэлектростанции небезвредны: они мешают полетам птиц и насекомых, шумят, отражают радиоволны вращающимися лопастями, создавая помехи приему телепередач в близлежащих населенных пунктах.

Принцип работы ветроустановок очень прост: лопасти, которые вращаются за счет силы ветра, через вал передают механическую энергию к электрогенератору. Тот в свою очередь вырабатывает электрическую энергию. Таким образом, энергия ветра превращается в электрический ток.

Для получения энергии ветра применяют разные конструкции: многолопастные «ромашки»; винты вроде самолетных пропеллеров; вертикальные роторы; некое подобие «вставшего дыбом» вертолетного винта. Вертикальные конструкции хорошо улавливают ветер любого направления.

Чтобы как-то компенсировать изменчивость ветра, сооружают огромные «ветреные фермы». Ветродвигатели там стоят рядами на обширном пространстве и работают на единую сеть.

Чтобы снизить зависимость от непостоянного направления и силы ветра, в систему включают маховики и разного рода аккумуляторы – электрические, воздушные и гидравлические.

Сейчас в мире работает более 30 тыс. ветроустановок различной мощности. Германия получает от ветра 10% своей электроэнергии, а всей Западной Европе ветер дает 2500 МВт электроэнергии. По мере того как ветряные электростанции окупаются, а их конструкции совершенствуются, цена воздушного электричества падает.

Task 8. Study the following patterns.

You don't have to answer all the questions – they may not be good questions! If it is a good question, thank the person and answer it. Some of the questions may be irrelevant and not connected to what you want to say. Say so and get another question. Some may be unnecessary because you have already given the answer. Repeat the answer briefly and get the next question. And some may be difficult because you don't have the information. Again, say so and offer to find the information or ask the person asking the question what they think. When you get a question, comment on it first. This will give you time to think.

- *That's a very interesting question.*
- *I'm glad you've asked that question.*
- *A good question.*
- *I'm sorry but I don't have that information to hand.*
- *Can I get back to you about that?*
- *I'm afraid I can't answer that.*
- *I'm not in a position to comment on that.*
- *As I said earlier, ...*
- *I think I answered that when I said ...*
- *I did mention that.*
- *I don't see the connection.*
- *I'm sorry, I don't follow you.*
- *I think that is a very different issue.*

Task 9. Choose appropriate ways of dealing with questions when you are the SPEAKER.

1. When you don't want to answer	a. If there are no more questions, we should stop there.
2. When someone interrupts you	

3. When you finally understand what they want to know	b. Oh I see. So what you are asking is ...
4. When you realize they don't understand what you said	c. Perhaps I didn't make myself clear. What I was trying to say was ...
5. If you don't want to tell everyone	d. Perhaps we can talk about it when I have finished.
6. To close off the presentation	e. Sorry, could I just finish?
	f. To be honest, I'm not really the person to ask about that.

Task 10. Choose appropriate ways of getting an answer when you are the QUESTIONER.

1. When the answer doesn't give you the information you want:	a. <i>That may be so, but I still think ...</i>
2. When the answer is evasive:	b. <i>Well, I'm not so sure. Can you give us an example to illustrate that?</i>
3. If you are skeptical and want more detail:	c. <i>Yes, but you still haven't answered my question.</i>
4. If you don't agree:	d. <i>Yes, that may be so, but what I want to know if ...</i>

Task 11. Cases

Case 1. *You are the speaker at the conference. While making your speech you notice some people in front of you behave in an unexpected for you way. Some of them seem not to understand you at all while the others are asking provocative questions trying to disprove your point of view. But you should remain polite no matter what is happening. So your task is to express your thoughts in the most polite way.*

Case 2. *You are the listener at the conference. While listening to the report you notice the speaker is not confident enough in what he (or she) is saying, or maybe, he/she just lack enough competence in the considered field. You want to bring him to light, or just clarify the points you don't understand. Keep in mind you should remain polite no matter what is happening. So your task is to express your thoughts in the most polite way.*

UNIT 11. SOLAR POWER PRODUCTION

Learning outcomes

- Discussing basic principles and methods of solar power generation
- Determining the environmental effects of solar power production
- Mastering the skills of rendering

Starting point

1. *What do you remember from the course of physics about photons?*
2. *Do you agree that solar power production is harmless for the environment?*

Task 1. Try to guess the marked words basing on the context.

The sun has produced energy for billions of years. Solar energy is the sun's rays (**solar radiation**) that reach the Earth. This energy can be **converted** into other forms of energy, such as heat and electricity.

When converted to **thermal (or heat) energy**, solar energy can be used to:

- Heat water — for use in homes, buildings, or swimming pools
- Heat spaces — inside homes, greenhouses, and other buildings

Solar energy can be converted to electricity in two ways:

- **Photovoltaic (PV devices) or “solar cells”** change sunlight directly into electricity. Individual PV cells are grouped into panels and **arrays** of panels that can be used in a wide range of **applications** ranging from single small cells that **charge** calculator and watch batteries, to systems that **power** single homes, to large power plants covering many acres.

- **Concentrating Solar Power Plants** generate electricity by using the heat from solar **thermal collectors** to heat a **fluid** which produces steam that is used to power the generator.

Solar thermal (heat) energy is often used for heating water used in homes and **swimming pools** and for heating the insides of buildings ("space heating").

Passive space heating is what happens to your car on a hot summer day. The **sun rays** heat up the inside of your car. In buildings, the air is circulated past a solar heat surface and through the building by **convection** (**less dense** warm air tends to rise while **denser** cool air moves downward). No mechanical equipment is needed for passive solar heating.

Two **drawbacks** of solar energy are:

- The amount of sunlight that arrives at the Earth's surface is not constant. It depends on **location**, time of day, time of year, and weather conditions.
- Because the sun doesn't deliver that much energy to any one place at any one time, a large surface area is required to collect the energy **at a useful rate**.

Task 2. Divide the text into logical parts and make its plan.

Task 3. Insert the missing words into the blanks. Mind that there are three irrelevant words.

Solar energy is by far the Earth's most *1)* energy source. Solar power is *2)* of providing many times the total current energy *3)*. But it is an intermittent energy source, meaning that it is not available at all *4)*. However, it can be supplemented by *5)* energy storage or another energy source, such as natural *6)* or hydropower.

Concentrating solar power technologies use mirrors to *7)* and concentrate sunlight onto receivers that collect the solar energy and *8)* it to heat. This thermal energy can then be used to produce electricity via a *9)* turbine or heat engine driving a *10)*.

available, capable, convert, conversion, demand, gas, generator, reflect, steam, supply, storage, thermal, times

Task 4. Restore the sentence order to make a logical coherent text.

1. Another solar generating technology uses photovoltaic cells (PV) to convert sunlight directly into electricity.

2. Covering 4% of the world's desert area with photovoltaics could supply the equivalent of all of the world's electricity.
3. Even larger plants than exist today are proposed for construction in the coming years.
4. Low-temperature solar collectors also absorb the sun's heat energy, but instead of making electricity, use the heat directly for hot water or space heating in homes, offices, and other buildings.
5. Photovoltaics can provide tiny amounts of power for watches, large amounts for the electric grid, and everything in between.
6. PV cells are made of semiconductors, such as crystalline silicon or various thin-film materials.

Task 5. Scan the text and find answers to the offered questions.

- *состав и конструкция устройства для преобразования солнечной энергии в электрическую – фотогальванического элемента;*
- *условия образования электрического тока в таких устройствах;*
- *условия эффективной работы данного устройства;*
- *основные преимущества данных устройств;*
- *вид тока, получаемый с помощью данных устройств*

A **photovoltaic cell**, commonly called a **solar cell** or **PV**, is the technology used to convert solar energy directly into electrical power. A photovoltaic cell is a non-mechanical device usually made from silicon alloys.

Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity. When enough sunlight (energy) is absorbed by the material (a semiconductor), electrons are dislodged from the material's atoms. When the electrons leave their position, holes are formed. When many

electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When the two surfaces are connected through an external load, such as an appliance, electricity flows.

The performance of a photovoltaic array is dependent upon sunlight. Climate conditions (such as clouds or fog) have a significant effect on the amount of solar energy received by a photovoltaic array and, in turn, its performance. Most modern modules are about 10% efficient in converting sunlight.

The simplest photovoltaic systems power many of the small calculators and wrist watches used every day. More complicated systems provide electricity to pump water, power communications equipment, and even provide electricity to our homes.

Some advantages of photovoltaic systems are:

1. Conversion from sunlight to electricity is direct, so that bulky mechanical generator systems are unnecessary.
2. PV arrays can be installed quickly and in any size.
3. The environmental impact is minimal, requiring no water for system cooling and generating no by-products.

Photovoltaic cells, like batteries, generate direct current (DC), which is generally used for small loads (electronic equipment). When DC from photovoltaic cells is used for commercial applications or sold to electric utilities using the electric grid, it must be converted to alternating current (AC) using inverters, solid state devices that convert DC power to AC.

Task 6. Restore the words and match the definitions to the corresponding parts of solar thermal power systems.

Solar thermal power plants use the sun's rays to heat a fluid to very **h...h** temperatures. The fluid is then **ci...d** through pipes so it can transfer its heat to

water to produce steam. The steam, in turn, is converted into mechanical energy in a turbine and into electricity by a conventional generator coupled to the turbine.

So solar thermal power generation works essentially the same as generation from fossil fuels except that instead of using steam produced from the combustion of fossil fuels, the steam is produced by the heat collected from sunlight. Solar thermal technologies use concentrator systems to achieve the high temperatures needed to heat the fluid.

The three main types of solar thermal power systems are:

Parabolic troughs	A solar dish/engine system	A solar power tower (central receiver)
<p>This system generates electricity from sunlight by focusing concentrated solar energy on a tower-mounted heat exchanger (receiver). This system uses hundreds to thousands of flat sun-tracking mirrors called heliostats to reflect and concentrate the sun's energy onto a central receiver tower. The energy can be concentrated as much as 1,500 times that of the energy coming in from the sun.</p> <p>Energy losses from thermal-energy transport are minimized as solar energy is being directly transferred by reflection from the heliostats to a single receiver, rather than being moved through a transfer medium to one central location, as with parabolic troughs. Power towers must be large to be economical. This is a promising technology for large-scale grid-connected power plants.</p>	<p>This type of collector has a long parabolic-shaped reflector that focuses the sun's rays on a receiver pipe located at the focus of the parabola. The collector tilts with the sun during the day to ensure that the sun is continuously focused on the receiver.</p> <p>The "solar field" has parallel rows of solar parabolic trough collectors aligned on a north-south horizontal axis. A working (heat transfer) fluid is heated as it circulates through the receiver pipes and returns to a series of "heat exchangers" at a central location. Here, the fluid circulates through pipes so it can transfer its heat to water to generate high-pressure, superheated steam. The steam is then fed to a conventional steam turbine and generator to produce electricity. When the hot fluid passes through the heat exchangers, it cools down, and is then recirculated through the solar field to heat up again.</p> <p>The plant is usually designed to operate at full power using solar energy alone, given sufficient solar energy. However, all parabolic trough plants can use fossil fuel combustion to supplement the solar output during periods of low solar energy, such as on cloudy days.</p>	<p>This plant uses concentrating solar collectors that track the sun, so they always point straight at the sun and concentrate the solar energy at the focal point of the dish. A solar dish's concentration ratio is much higher than a solar trough's, typically over 2,000. The power-generating equipment used with a solar dish can be mounted at the focal point of the dish, making it well suited for remote operations or, as with the solar trough, the energy may be collected from a number of installations and converted to electricity at a central point.</p> <p>The engine in a solar dish/engine system converts heat to mechanical power by compressing the working fluid when it is cold, heating the compressed working fluid, and then expanding the fluid through a turbine or with a piston to produce work. The engine is coupled to an electric generator to convert the mechanical power to electric power.</p>

Task 7. Each sentence contains 1-2-3 excessive words (their number is stated in brackets). Find all these words and make the final sentence of the text.

Solar Energy and the Environment

Using solar energy produces no air or water pollution and no greenhouse gases, but does have some using indirect impacts on the environment (1). For example, there are some toxic materials and chemicals, and various solvents and alcohols that are used in the water manufacturing process of photovoltaic cells (PV), from which convert sunlight into electricity (2). Small underground amounts of these waste materials are wells produced (2).

In addition, large solar thermal power plants can harm desert ecosystems if may not properly managed (1). Birds and affect insects can be the killed if they fly into a concentrated ecosystem beam of sunlight, such as that created by a "solar power tower" (3). Some solar thermal systems use in potentially hazardous fluids (to transfer heat) that some require proper handling and disposal (2).

Concentrating solar systems may require arid water for regular cleaning locations of the concentrators and receivers and for cooling the turbine-generator (2).

The last sentence: ... (13 words).

Task 8. Render the text in English.

Различают несколько типов электростанций, вырабатывающих электричество из солнечной энергии. На острове Сицилия еще в начале 80-х годов дала ток солнечная электростанция мощностью 1 МВт. Принцип ее работы – башенный. Зеркала фокусируют солнечные лучи на приемнике, расположенном на высоте 50 м. Та м вырабатывается пар с температурой более 500° С, который приводит в действие традиционную турбину с подключенным к ней генератором тока. При переменной облачности недостаток солнечной энергии компенсируется паровым аккумулятором. На таком принципе могут работать электростанции мощностью 10-20 МВт.

Несколько иного типа электростанция на юге Испании. Ее отличие в том, что сфокусированное на вершину башни солнечное тепло приводит в движение натриевый круговорот (как в атомных реакторах на быстрых нейтронах), а тот уже нагревает воду до образования пара. У такого варианта ряд преимуществ. Натриевый аккумулятор тепла обеспечивает не только непрерывную работу электростанции, но дает возможность частично накапливать избыточную энергию для работы в пасмурную погоду и ночью. Мощность станции всего 0,5 МВт. Но на ее принципе могут быть созданы куда более крупные – до 300 МВт. В установках подобного типа концентрация солнечной энергии настолько высока, что КПД ничуть не хуже, чем на традиционных тепловых электростанциях.

Task 9. Study the following patterns.

When we are giving lots of information, we often use visuals to give an overview. However, we often need to highlight only one or two key points or figures and then comment on them. Here's some language to help you.

- *The following table contains ...*
- *A more profound examination reveals ...*
- *Statistics showed ...*
- *A few figures will illustrate ...*
- *We have no reliable figures, but it is clear that ...*
- *Authoritative surveys showed ...*
- *A set of figures will indicate ...*
- *This example illustrates well enough ...*
- *These examples will suffice to show that ...*
- *This may serve as a good example of ...*

Task 10. Complete the sentences with the words given below.

1. Let's (1) now on what these figures mean for the future.
2. I'd like us to (2) our attention to this part of the graph.
3. I'd like to (3) out the small difference in these figures.

4. This figure doesn't (4) any adjustment for fluctuations in exchange rates.
5. We need to (5) about how we can improve this figure.
6. I should (6) the significance of these numbers.
7. I'd like to (7) your attention to this figure.
8. This figure (8) only to returns received during the past quarter.
9. Now, let's (9) in more detail at the underlying trend.

turn, focus, refers, mention, look, point, draw, include, think

Task11. Reorganize the text.

1. performance is good, we need to think
2. your attention on where our sales come from. Let's look
3. Our biggest market and Italy and Spain have not grown. The implications
4. at the breakdown by region. This represents
5. Let's now turn our
6. market and it has grown significantly. But, if we now look at the breakdown of Europe
7. attention to last quarter's figures. I'd like to focus
8. in more detail, you'll notice that Germany is still
9. about how we can improve sales in Italy and Spain.
10. sales in Europe. As you can see, this is our biggest
11. are clear to all of us. Although our overall

Task12. Restore the text.

Let's now turn our **1)** to last quarter's figures. I'd like to **2)** your attention on where our sales come from. Let's **3)** at the breakdown by region. This **4)** sales in Europe. **5)** you can see, this is our biggest market and it has grown significantly. But, if we now look at the **6)** of Europe **7)**, you'll **8)** that Germany is still our biggest market and Italy with Spain have not grown. The **9)** are **10)** to all of us. Although our overall **11)** is good, we need to think **12)** how we can improve sales in Italy and Spain.

UNIT 12. HYDROGEN AS A POWER SOURCE

Learning outcomes

- Discussing the use of hydrogen in power production
- Describing the use of hydrogen fuel cells and its prospects
- Mastering the skills of dealing with confusable words

Starting point

1. *What do you remember from the course of chemistry about hydrogen?*
2. *Do you agree that hydrogen power production is highly promising?*

Task 1. Insert the appropriate words into the blanks. Mind that there are three irrelevant words.

The sun is basically a giant ball of hydrogen gas undergoing **1)** into helium gas and giving off vast amounts of radiant energy in the process. In the sun's core, hydrogen atoms **2)** to form helium atoms. This radiant energy **3)** life on Earth. It gives us light and makes plants grow. It makes the wind blow and rain fall. It is stored as **4)** energy in **5)** fuels. Hydrogen gas is so much lighter than air that it rises fast and is quickly **6)** from the atmosphere. This is why hydrogen as a gas (H_2) is not found by itself on Earth. It is found only in **7)** form with other elements. Hydrogen combined with **8)**, is water (H_2O). Hydrogen combined with **9)** forms different compounds, including methane (CH_4), coal, and petroleum. Hydrogen is also found in all growing things — for example, **10)**. It is also an abundant element in the Earth's crust. Hydrogen has the **11)** energy content of any common fuel by **12)** (about three times more than gasoline), but the **13)** energy content by **14)** (about four times less than gasoline).

biomass, carbon, chemical, combine, compound, ejected, effect, fossil, fusion, highest, lowest, lower, oxygen, sustains, volume, weight, wide

Task 2. Choose the only one appropriate word.

Energy carriers move energy in a **feasible/useable/applicable** form from one place to another. Electricity is the most **well-established/well-known/well-built** energy carrier. Electricity is used to **move/transform/retrieve** the energy in coal, uranium, and other energy sources from power **plants/trains/sources** to homes and businesses. For many energy needs, it is much easier to **implement/use/convert** electricity than the energy sources themselves. Like electricity, hydrogen is an energy **consumer/conductor/carrier** and must be produced from another substance. Hydrogen is not currently widely used, but it has **potential/alternative/disadvantage** as an energy carrier in the future. Hydrogen can be produced from a variety of **streams/sources/springs** (water, fossil fuels, or biomass) and is a(an) **output/byproduct/catalyst** of other chemical processes.

Task 3. Restore the sentences.

1. As hydrogen doesn't exist on Earth as a gas, ...	a. even some algae and bacteria give off hydrogen.
2. Hydrogen atoms can be separated from ...	b. it must be separated from other elements.
3. The two most common methods for producing hydrogen are ...	c. the shuttle's electrical systems.
4. Scientists have discovered that ...	d. results in greenhouse gas emissions that are linked with global warming.
5. Steam reforming is currently ...	e. results in no emissions, but it is currently an expensive process.
6. Steam reforming ...	f. space shuttles into orbit.
7. Electrolysis is a process that ...	g. splits hydrogen from water.
8. Electrolysis ...	h. steam reforming and electrolysis (water splitting).
9. Liquid hydrogen fuel lifts ...	i. the least expensive method used in industries to separate hydrogen atoms from carbon atoms in methane.
10. Hydrogen fuel cells power ...	j. water, biomass, or natural gas molecules.

Task 4. Look through the text and give answers to the following questions:

1. *Дайте характеристику водородным топливным элементам.*
2. *Где применяются водородные топливные элементы?*
3. *Почему в ближайшем будущем не предусмотрено строительство крупных водородных электростанций?*
4. *Где используются портативные топливные элементы?*

Hydrogen fuel cells make electricity. They are very efficient, but expensive to build. Small fuel cells can power electric cars. Large fuel cells can provide electricity in remote places with no power lines. Because of the high cost to build fuel cells, large hydrogen power plants won't be built for a while. However, fuel cells are being used in some places as a source of emergency power, from hospitals to wilderness locations. Portable fuel cells are being sold to provide longer power for laptop computers, cell phones, and military applications.

Task 5. Restore the incomplete forms.

Most of the presently used hydrogen-**f...ed** vehicles are buses and automobiles **p...ed** by electric motors. They store hydrogen gas or liquid on board and **co...t** the hydrogen into electricity for the motor **u...ing** a fuel cell. Only a few of these vehicles burn the hydrogen directly (**p...ing** almost no pollution). The present cost of fuel cell vehicles greatly exceeds that of conventional vehicles due to the expense of **p...ing** fuel cells. Hydrogen vehicles are **s...ing** to move from the laboratory to the road.

Task 6. Study the names of the parts of a business table.

Tables are a popular method of showing/presenting to people data/information. Like charts, tables are used to organize data, so the data is easier to understand. Although tables are not as visual as charts/graphs, they are very useful when you want to show people the actual numbers and figures. This is the reason why they are commonly used in reports. In the below table about the changes in the number of employees in British banks, you will find that the different parts are surrounded/enclosed by a red line with a number in red. These red numbers are used below the table to confirm the name of each part. Knowing this vocabulary is important when either describing or explaining a table to people.

Table 1: The change in the number of employees in five small British banks between 1990 and 2010.

Companies	1990	1995	2000	2005	2010
Fisher plc	13,005	14,000	16,123	16,450	15,254
Skipton Bank plc	n/a	3,675	5,329	<u>7,897</u>	6,398
Saving's Bank	19,729	19,805	<i>26,198</i>	32,668	24,484
Your Money plc	6,591	6,302	6,892	7,547	7,239
Scottish Money plc	15,038	16,669*	18,093	20,668	18,453

* The number is estimated because of lack of information.
n/a The bank did not exist in this year.

- 1 – title, 2 – column titles, 3 – column, 4 – row, 5 – not available, 6 – underlined, 7 – italics, 8 – bold, 9 – highlighted, 10 – asterisk, 11 – footnotes

Task 7. Using the words given in the previous exercise, restore the sentences by choosing appropriate definitions.

- When a cell(s) contains 'n/a', it means that the data is
- When a cell(s) has a different colour to other cells, it is
- The name of the table/chart, is the
- The symbol '*' next to data/information in a table, is called an
- When a word or number is written like this 'fish', it is in
- A vertical group of cells in a table, is called a
- Extra information about the data in a table or chart, is written in the
- When a word or number is written like this '210', it is
- The words/numbers in the first/top row of a table, are called
- When a word or number is written like this '-15.71', it is in
- A horizontal group of cells in a table, is called a

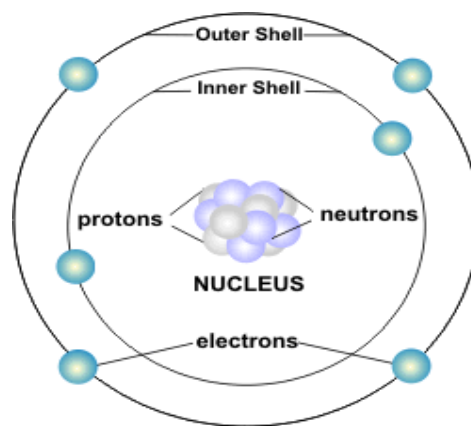
UNIT 13. ELECTRICITY AS A SECONDARY POWER SOURCE

Learning outcomes

- Discussing the phenomena of electricity and basic terms relating to it
- Describing the process of electricity generating
- Mastering the skills of rendering pictures into text information

Starting point

1. *What do you remember from the course of physics about electric current, lightning and static electricity?*
2. *Can you explain what you see in this picture?*



Task 1. Look through the text and choose the only one appropriate word.

Electricity is the **fly / flow/ flight** of electrical power or charge. It is both a basic part of nature and one of our most widely **using / used /usable** forms of energy. Electricity is actually a secondary energy source, also referred to as an energy **carrier / bearer / holder**. That means that we get electricity from the **conversation / conservation / conversion** of other sources of energy, such as coal, nuclear, or solar energy, which are called primary sources.

Many scientists and inventors have worked to **decipher / decide / despise** the principles of electricity since the 1600s. Some notable accomplishments were made by Benjamin Franklin, Thomas Edison, and Nikola Tesla. Benjamin Franklin demonstrated that **lighting / light / lightning** is electricity. Thomas Edison

invented the first long-lasting **transcendent /incandescent / transversal** light bulb.

Prior to 1879, direct current (DC) electricity had been used in arc lights for **indoor / outdoor / door** lighting. In the late 1800s, Nikola Tesla **discovered / invented / pioneered** the generation, transmission, and use of alternating current (AC) electricity, which reduced the cost of **transmitting / transforming / transgressing** electricity over long distances. Tesla's inventions used electricity to bring **indoor / door / outdoor** lighting to our homes and to power industrial machines.

Task 2. Look through the text and guess the meaning of the words in a bold type.

Everything in the **universe** is made of atoms – the human body, air and water. Atoms are the building blocks of the universe. They are so small that millions of them would **fit** on the head of a pin.

The center of an atom is called the **nucleus**. It is made of particles called **protons** and **neutrons**. The protons and neutrons are very small, but electrons are much, much smaller. **Electrons spin** around the nucleus in **shells** a great distance from the nucleus. Atoms are mostly empty space.

If you could see an atom, it would look a little like a tiny center of **balls** surrounded by giant invisible **bubbles** (or shells). The electrons would be on the surface of the bubbles, constantly spinning and moving to stay as far away from each other as possible. Electrons are held in their shells by an electrical force.

The protons and electrons of an atom are attracted to each other. They both carry an **electrical charge**. Protons have a positive charge (+) and electrons have a negative charge (-). The positive charge of the protons is equal to the negative charge of the electrons. **Opposite** charges **attract** each other, while like charges repel each other.

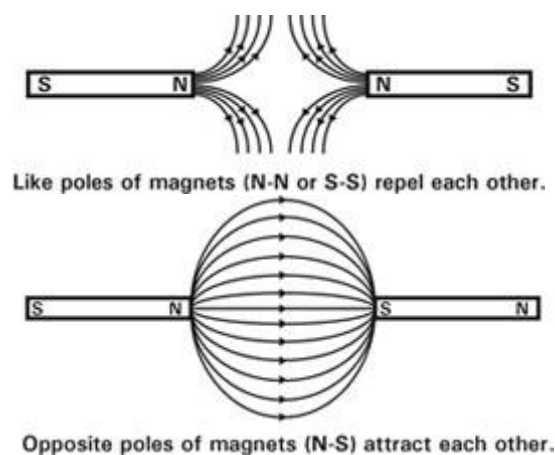
An atom is in balance when it has an equal number of protons and electrons. The neutrons **carry** no charge and their number can **vary**.

The number of protons in an atom determines the kind of atom, or **element**, it is. An **element** is a substance consisting of one type of atom, all with the same number of protons. Every atom of hydrogen, for example, has one proton, and every atom of **carbon** has six protons. The number of protons determines which element it is.

Electrons usually remain a constant distance from the nucleus in precise **shells**. The electrons in the shells closest to the nucleus have a strong **force of attraction** to the protons. Sometimes, the electrons in an atom's outermost shells can be pushed out of their orbits. Applying a force can make them move from one atom to another. These moving electrons form electricity. Lightning is a form of electricity. It is electrons moving from one cloud to another or jumping from a cloud to the ground.

Have you ever felt a **shock** when you touched an object after walking across a carpet? A stream of electrons **jumped** to you from that object. This is called **static electricity**.

Task 3. Look at the picture and try to describe it.



Now, check yourself and insert the words into the blanks. Mind that there are three irrelevant words.

The spinning of the electrons **1**) the nucleus of an atom creates a tiny magnetic field. Most objects are not magnetic because their electrons spin in different, random **2**), and cancel out each other.

The **3)** in magnets are arranged so that their electrons spin in the same direction. This arrangement of atoms creates two poles in a magnet, a North-seeking pole and a South-seeking pole.

The magnetic force in a magnet **4)** from the North pole to the South pole. This creates a **5)** around a magnet.

Magnets placed close to each other don't act like most objects. If you try to push the South or North poles together, they will **6)** each other. But the North (N) and the South (S) poles are **7)** to each other. Just like protons and electrons — **8)** attract.

Properties of magnets can be used to make electricity. Moving magnetic fields can pull and push electrons. For example, electrons in copper wires can easily be **9)** from their shells by moving magnets. By using moving magnets and copper wire together, electric **10)** produce electricity. Electric generators essentially **11)** kinetic energy (the energy of motion) into electrical energy.

around, attracted, convert, conversion, directions, flows, generators, generate, magnetic field, molecules, opposites, pushed, reaction, repel

Task 4. Match basic terms with their definitions.

Terms	Definitions
1. Battery	a. This is a closed loop, along which electricity travels. It must have a complete path before the electrons can move. If it is open, the electrons cannot flow. When we flip on a light switch, we close the loop. When we flip the switch off, we open the circuit.
2. Load	b. This device changes electricity produced by a generator from low voltage to high voltage or vice versa, thus allowing electricity to be efficiently transmitted over long distances
3. Circuit	c. These cables carry the electricity from the substation to homes, offices, and factories, which require low voltage electricity.
4. Bulb	d. This device produces electricity using two different metals in a chemical solution. A chemical reaction between the metals and the chemicals frees more electrons in one metal than in the other. The end that frees more electrons develops a positive charge and the other end develops a negative charge. If a wire is attached from one end of the device to the other, electrons flow through the wire to balance the electrical charge.
5. Transformer	e. These are cables used to carry the high-voltage electricity from the power plant to a substation.

6. Transmission lines	f. This is a device that does work or performs a job. If a light bulb is placed along the wire, the electricity can do work as it flows through the wire. The electricity flows from the negative end of the battery through the wire to the light bulb and back to the positive end of the battery.
7. Distribution lines	g. When we turn a light switch on, electricity flows through a tiny wire in this device. The wire gets very hot. It makes the gas in the device glow. When the tiny wire has broken, the device is said to burn out.

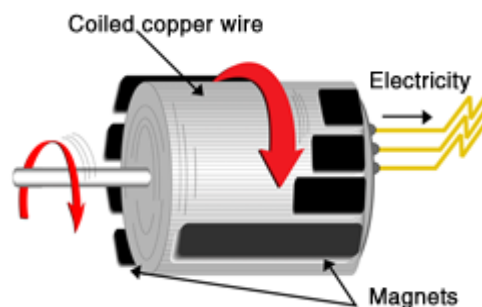
Task 5. Guess the missing words.

Electric power is measured in units of power called **1**). It was named to honor James Watt, the inventor of the steam engine. One **2**) is a very small amount of power. It would require nearly 750 **3**) to equal one horsepower. A **4**) is the same as 1,000 **5**). The amount of electricity a power plant generates or a customer uses over a period of time is measured in **6**) (kWh). This unit means the energy of 1,000 **7**) working for one hour and is determined by multiplying the number of **8**) required by the number of hours of use.

Task 6. Scan the text and get ready to answer these questions.

- 1) *На чем основан принцип действия электрогенератора?*
- 2) *Из каких частей он состоит?*
- 3) *Как образуется электричество в генераторе?*

A generator is a device that converts mechanical energy into electrical energy. The process is based on the relationship between magnetism and electricity. In 1831, scientist Michael Faraday discovered that when a magnet is moved inside a coil of wire, electrical current flows in the wire.



A typical generator at a power plant uses an electromagnet - a magnet produced by electricity. The generator has a series of insulated coils of wire that

form a stationary cylinder. This cylinder surrounds a rotary electromagnetic shaft. When the electromagnetic shaft rotates, it induces a small electric current in each section of the wire coil. Each section of the wire becomes a small, separate electric conductor. The small currents of individual sections are added together to form one large current. This current is the electric power that is transmitted from the power company to the consumer.

Task 7. Match the sentence parts to determine how electricity gets to consumers.

1. An electric utility power station uses either a turbine, engine, water wheel, or other similar machine to drive ...	a. an electric generator — a device that converts mechanical or chemical energy to electricity.
2. Steam turbines, internal-combustion engines, gas combustion turbines, water turbines, and wind turbines are	b. known as the "grid."
3. Electric power is generated at power plants and then ...	c. most common methods to generate electricity.
4. A network of thousand miles of high voltage transmission lines is ...	d. moved to substations by large high-voltage power transmission lines.
5. A local distribution system of smaller lower-voltage distribution lines moves ...	e. power from substations and transformers to customers.

Task 8. Study the names of the parts of a line graph/chart.

One of the most common methods of presenting/showing data to people is in a line graph/chart. By displaying data in a visual way, it makes the data easier for people to understand. This is the reason why graphs/charts are used in business presentations, reports etc. In the below line graph about the changes in the number of employees in British banks, you will find that the different parts are either surrounded/enclosed by a red line with a number in red or just have a red number next to them. These red numbers are used below the chart to confirm the name of each part. Knowing this vocabulary is important when either describing or explaining a graph/chart to people.

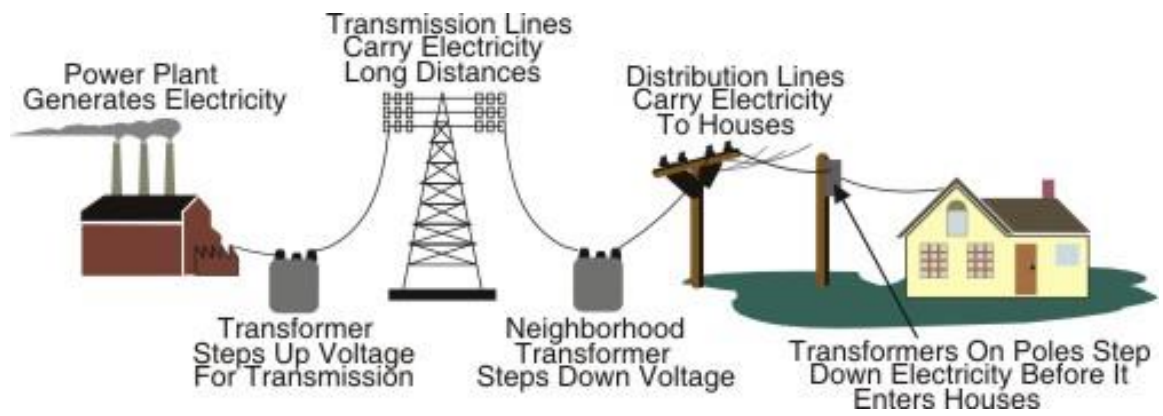


- 1 – title, 2 – dotted line, 3 – unit of measure, 4 – key, 5 – line, 6 – dashed line, 7 – vertical axis, 8 – horizontal axis, 9 – axis title, 10 – source, 11 – footnotes

Task 9. Using the words given in the previous exercise, restore the sentences by choosing appropriate definitions.

1. On a graph, this ' — ' is called a
2. A graph/chart is made of a vertical axis and a
3. The place where the details of where the data/information in the graph comes from, is called the
4. In an axis title, this '(in millions)' is called the
5. On a graph, this type of line '-----' is called a
6. Extra information about the data in a table or chart, is written in the
7. The name or label of an axis, is also called the
8. A section in graphs/charts that inform you what the lines mean/represent, is the
9. The name of the table/chart, is the
10. A graph/chart is made of a horizontal axis and a
11. On a graph, this type of line '.....' is called a

Task 10. Prepare a short presentation on the electric power generation, transmission, and distribution diagram. Can you offer any solutions on how to optimize this process?



Task 11. Role-play activity. In a discussion panel format consider various dangers from electrical appliances used at homes and hostels and develop recommendations on their safe and optimal utilization.

UNIT 14. POWER PRODUCTION VS. ENVIRONMENT PROTECTION

Learning outcomes

- Discussing the environmental effects of power production from different sources
- Determining the eco-friendly ways of power production
- Mastering the skills of abstract making

Starting point

1. *What do you remember from the course of biology about the environment pollution?*
2. *Do you agree that some ways of power production are less harmful for the environment?*

Task 1. Find the English equivalents and answer the questions.

a) *безопасный, воздействие, зона расположения, расчистка местности, подъездной путь, трубопровод, ландшафт, экологически чистый (нетронутый)*

b) *What do you understand by a physical imprint of power transmission networks? What are specific requirements made for some areas where power transmission lines are to be located? How can power plants change the landscape?*

Although electricity is a clean and relatively safe form of energy to use, there are environmental impacts associated with the production and transmission of electricity. Nearly all types of electric power plants have some impacts or effects on the environment, some more than others.

All power generators or plants have a physical footprint (the area where they are placed or located). Some can be located inside, on, or next to an existing building, so the impact of their footprint is very small. Most large power plants require clearing land to locate the power plant and any necessary fuel storage areas (in the case of hydro-power dams, a reservoir forms behind the dam). Some plants

may also require the construction of access roads, rail, pipelines, transmission lines, and access to cooling water supplies or reservoirs.

Besides the physical footprint, many power plants are large physical structures that have impacts on the visual landscape. Some people may not like this especially where the landscape is relatively natural or pristine.

In general, the larger the area disturbed is, the greater the real and potential impacts on the landscape can be.

Task 2. Match the sentence parts stating cause-and-effect relationships.

Fossil fuels (mainly coal, oil, and natural gas), materials that come from plants (biomass), and municipal and industrial wastes are used to generate most of the electricity we use. But nearly all combustion byproducts have negative impacts on the environment and human health:

1. Carbon dioxide (CO ₂)	a. can be hazardous to human and animal health.
2. Sulfur dioxide (SO ₂)	b. causes acid rain, which is harmful to plants and to animals that live in water, and it worsens or causes respiratory illnesses and heart diseases, particularly in children and the elderly.
3. Nitrogen oxides (NOX)	c. contribute to ground level ozone, which irritates and damages the lungs.
4. Particulate matter (PM)	d. is a greenhouse gas and a source of global warming.
5. Heavy metals such as mercury	e. results in hazy conditions in cities and scenic areas, and, along with ozone, contributes to asthma and chronic bronchitis, especially in children and the elderly. Very small, or “fine” elements is also thought to cause emphysema and lung cancer.

Task 3. Restore the words.

Power plants are required to meet **s...s** that limit the amounts of some of the substances released into the **a...** There are different ways that power plants do this:

- Coal-fired plants can use coal that is low in sulfur content. Coal can also be pre-treated and processed to **re...e** the types and amounts of **un...ble** compounds in combustion gases.
- Particulate matter emissions are controlled with devices that clean the combustion gases that **e...t** the power plant:

- “Bag-houses” use large **f...s**
- Electrostatic precipitators use charged plates
- Wet scrubbers use a **l...d** solution
- SO₂ emissions are controlled by wet and dry scrubbers, which involves **mi...g** lime in the fuel (coal) or by spraying a lime solution into the combustion gases. Fluidized bed combustion can also be used to control SO₂.
- NOX emissions can be controlled by several different techniques and technologies, such as low NOX burners during the combustion phase or selective catalytic and non-catalytic **con...s** during the post combustion phase.

Task 4. Insert the words into the blanks. Mind that there are three irrelevant words.

Nuclear power plants are not a **1)** of greenhouse gases or other emissions, but they do **2)** two kinds of radioactive waste:

- **Low-level radioactive waste** — This includes items that have become contaminated with radioactive material, such as clothing, wiping rags, mops, filters, reactor water treatment residues, and **3)** and tools. Low-level waste is **4)** at nuclear power plants until the radioactivity in the waste decays to a level where it is **5)** to be disposed of as ordinary trash or it is sent to a low-level waste disposal site.

- **Spent (used) nuclear fuel** — The spent fuel assemblies are highly **6)** and must initially be stored in specially designed pools resembling large swimming pools (water **7)** the fuel and acts as a radiation shield) or in specially designed **8)** storage containers. An increasing number of reactor operators now **9)** their older spent fuel in dry storage facilities using special **10)** concrete or steel containers with air cooling.

allowed, cools, dry, equipment, indoor, outdoor, produce, production, radioactive, restore, source, store, stored

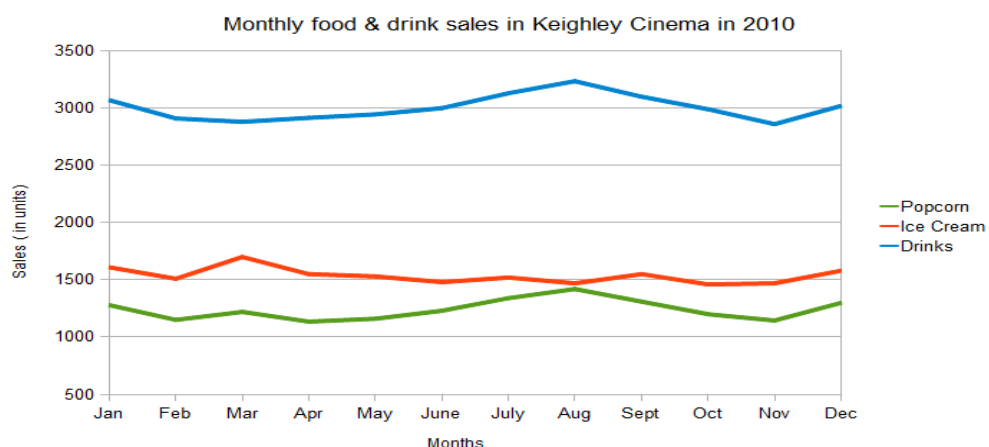
Task 5. Look through the text and offer pro and counter arguments for above-the-ground and underground power distribution lines.

Power transmission and distribution lines carry electricity from power plants to customers. Most transmission lines are strung above ground on large towers. The towers and lines impact the visual landscape, especially when they pass through pristine natural areas. Trees near the wires may be disturbed and have to be managed to keep them from touching the wires and these activities can affect native plant populations and wildlife. Power lines can be placed under the ground, but this is more expensive and may result in a greater disturbance of the landscape than overhead lines.

Task 6. Study the English vocabulary for explaining and comparing data and trends on charts/graphs.

Although it is essential to know how to describe the changes in the values of data on a chart (i.e. the increases and decreases) that are used in business reports or presentations, you also need to be able to explain and compare. With explaining, you need to be able to say what the lines/bars and chart represent, and what the data means or demonstrates. In charts with multiple lines or bars, you will also have to be able to make comparisons between them.

Read the following presentation by a Manager about the monthly sales of food and drink in a cinema. Focus on how the Manager explains and compares the data contained in the below chart. Using the both context and the chart, try to guess what the meaning of the words/phrases in **bold** are.



Manager: 'The above chart **shows** the monthly food and drink sales in the Keighley cinema during 2010. The chart shows unit sales. **As you can see**, there are three lines on the chart. The sales of popcorn **are represented by** the green line. The blue line **represents** drinks. The red line represents ice cream. The chart **demonstrates** that drinks are **by far** the biggest type of food and drink sold in the cinema throughout the year.

The chart also shows that there is a **correlation** between popcorn sales and drinks. When popcorn sales rise, there is also a rise in the sales of drinks. This trend supports the theory that people drink more when they eat food that contains a lot of salt. During the summer, sales of drinks and popcorn showed a steady increase, **by contrast**, unit sales of ice cream actually fell slightly. In fact, sales of ice cream fell from April to July, falling from 1025 units to 821 units per month **respectively**. These results would seem to **contradict** the idea that people consume more ice cream during summer, because as we can see from the results there is **no link**.

Lastly, the results **indicate** that during the Christmas period of December to January, people are willing to spend more money. Sales of all three types of products went up during the period. But this could be due to a general increase in attendance at that time of year.'

Task 7. Using the bold words from the previous exercise, restore the sentences by choosing appropriate definitions.

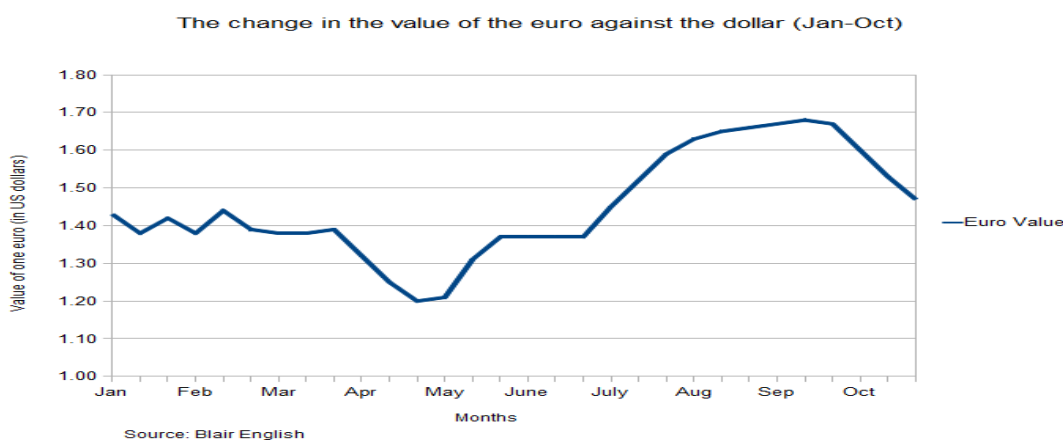
1. Another way to say 'disagree with', is
2. A verb that is used to introduce and describe the purpose of a chart or table, is
3. A different way to say 'shows/confirms that', is
4. A phrase that is used to show there is a difference in the results between two objects/things, is
5. A different way to say 'represents', is
6. A verb that means that the data is making a strong suggestion, is

7. A word that is used to say to which object/thing two different numbers/words belong or refer to, is
8. A word that means 'connection', is
9. A way to focus people's attention on a chart or table, is
10. A way to say that something is a lot more important or bigger than other objects/factors, is
11. A different way to say 'is represented by', is
12. A phrase that means 'no correlation', is

Task 8. Continue studying the English vocabulary for explaining and comparing data and trends on charts/graphs.

In the last two exercises on describing trends, we looked at the different ways to describe increases and decreases in graphs/charts (e.g. rise, fall sharply, and etc.). It is important to know this, but if you want to sound more fluent when describing changes in graphs/charts, you need to know more advanced vocabulary.

Read the following presentation by an analyst about the changes in the value of the euro against the US dollar. Focus on how the analyst describes the changes in its value and how they compare to the data/information in the chart below. Using both the context and the chart, try to guess what the meaning of the words/phrases in **bold** are.

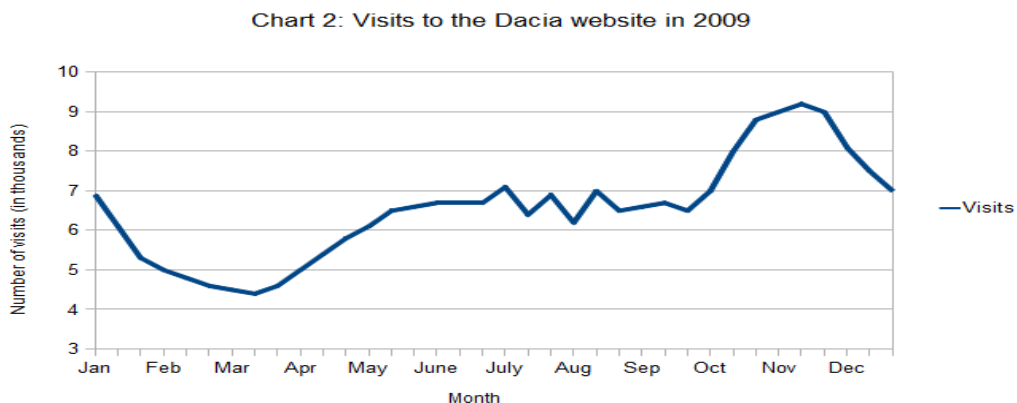


Analyst: 'This chart shows the changes in the value of the euro against the US dollar between January and October of 2010. As you can see, in January and

February the value of one euro **fluctuated** between \$1.38 and \$1.45. By March, this fluctuation stopped and the value **settled down**. During the month of April, the value of the euro **plunged**. It reached its **lowest point** of \$1.20 at the end of April. During May, the value of the euro **recovered**. Slightly at first, but then more sharply between the middle and the end of the month.

Throughout the month of June, the value of the euro remained **constant** at a value of \$1.37. But this changed in July, when the value **soared** from \$1.37 to \$1.66 due to fears about the level of US government debt. In August, this dramatic rise **levelled off**. This levelling off continued into the month of September, where the euro's value **peaked** at \$1.68. But during October the value **fell back**, finishing the month with a value of \$1.47.'

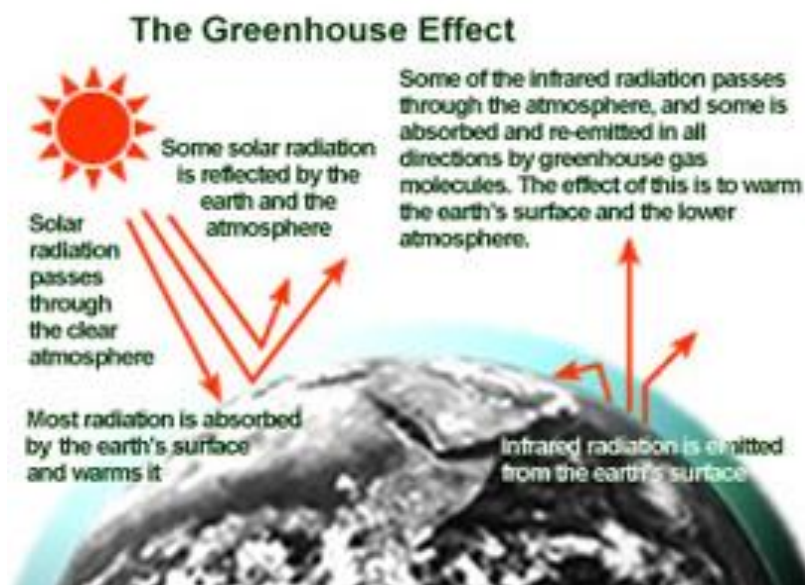
Task 9. Using the bold words from the previous exercise, restore the sentences according to the data in the below Website Visiting chart.



1. In January, the number of visits
2. In February, the fall in visits
3. In March, the number of visits reached its
4. In April and May, the number of visits
5. During June, the number of visits remained
6. 6. During July and August, the number of visits
7. In September, the number of visits
8. But in October, the number of visits

9. In November, the number of visits
10. In December, the number of visits

Task 10. Look at the picture and prepare a short presentation on the causes of the greenhouse effect.



Task 11. Make an annotation of the texts (See Appendix 1)

Text 1

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases." These gases allow sunlight to enter the atmosphere freely. When sunlight strikes the Earth's surface, some of it is reflected back towards space as infrared radiation. Greenhouse gases absorb this infrared radiation and trap its heat in the atmosphere. Many gases have greenhouse properties.

CO₂ is the main greenhouse gas. Approximately 81% of human-caused greenhouse gas emissions were CO₂ emissions, resulting from the use of petroleum, coal, and natural gas. Another greenhouse gas, methane, comes from landfills, coal mines, oil and natural gas operations, and agriculture; it represents about 11% of total emissions. Nitrous oxide (4% of total emissions) is emitted through the use of nitrogen fertilizers, burning fossil fuels, and industrial and waste management processes.

During the past 20 years, about three-quarters of human-caused (anthropogenic) emissions came from burning fossil fuels. Concentrations of carbon dioxide in the atmosphere are naturally regulated by numerous processes collectively known as the "carbon cycle."

Text 2

Основу современной мировой энергетики составляют тепло - и гидроэлектростанции. Однако их развитие сдерживается рядом факторов. Стоимость угля, нефти и газа, на которых работают тепловые станции, растет, а природные ресурсы этих видов топлива сокращаются. К тому же многие страны не располагают собственными топливными ресурсами или испытывают в них недостаток. В процессе производства электроэнергии на ТЭС происходит выброс вредных веществ в атмосферу. Причем если топливом служит уголь, особенно бурый, малоценный для другого вида использования и с большим содержанием ненужных примесей, выбросы достигают колоссальных размеров. И, наконец, аварии на ТЭС наносят большой ущерб природе, сопоставимый с вредом любого крупного пожара.

Выбросов в воздух от ГЭС нет никаких, но зато вред водной среде наносит довольно большой. В первую очередь страдают рыбы, которые не могут преодолеть плотины ГЭС. На реках, где построены гидроэлектростанции, особенно если их несколько – так называемые каскады ГЭС, - резко меняется количество воды до и после плотин. На равнинных реках разливаются огромные водохранилища, и затопленные земли безвозвратно потеряны для сельского хозяйства, лесов, лугов и расселения людей. Что касается аварий на ГЭС, то в случае прорыва любой гидроэлектростанции образуется огромная волна, которая сметет все находящиеся ниже плотины ГЭС.

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Useful patterns for informative abstract writing

INTRODUCTION	The article/text/publication under review / discussion		aims at/ concentrates on/at <i>providing/giving/surveying/describing/ explaining/examining ...</i>
	The purpose / subject / aim of the paper / book / article under consideration is		deals with the problem of ... gives us a sort of information on ... tells us about ...
MAIN BODY	To begin with At the beginning First Then/Second After that Further on/Furthermore Moreover In addition To finish with At the end Finally In conclusion	The author (s)	<ul style="list-style-type: none"> • describes/ gives a thorough description • dwells on • explains • touches upon • analyses /gives a detailed (thorough)analysis • characterizes / comments on • underlines / emphasizes • reveals / shows • thinks/ believes / considers • assumes / supposes • notices / points out • announces / reports • claims / states / asserts / argues • gives account of / estimates • provides examples of ... • passes on to / goes on saying that ... • outlines the effectiveness of • draws the conclusion • sums it all up by saying that . . .
	The article begins/opens with The title problem in the article is		the analysis/description/review of
CONCLUSION	Summary	The article/publication/report summarizes ... There is a brief summary of ... The paper provides a summary of	<ul style="list-style-type: none"> • currently established principles of ... • main / principle advances in • experimental studies carried out on the problem(s) of ...
	Supplements	The book/paper/report/article includes/is supplemented with /contains	a full bibliography/photographs/a list of tables schematic diagrams of/illustrations

<i>Practical utility</i>	I think /suppose / believe /consider To my mind In my opinion From my point of view	This paper presents an alternative / advanced method of ... The method/new approach is/can be applicable to ... The paper gives information on the applicability of ... The paper is highly recommended to all those working at ... Comprehensive studies of... are of particular importance to... This information will be most useful for ... The theoretical / experimental methods reported in this paper should be of interest to ... The new methods of... also had to be involved in ... There is much practical information on ...
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Practical assignment. Analyze the annotation patterns and clichés. Basing on them, translate the following sentences.

1. Рассматриваемая статья имеет своей целью описание новой *установки по производству электричества*.
2. Целью данной публикации является изучение опыта использования *возобновляемых источников энергии*.
3. Вначале автор затрагивает общие проблемы в отрасли.
4. Затем он подробнее останавливается на возможных путях их решения.
5. Далее он указывает на основные недостатки новых технологий.
6. В дополнение, он приводит примеры альтернативных решений.
7. В заключение, даётся общая оценка эффективности предлагаемого метода.
8. Ключевой проблемой статьи является обзор ... *альтернативных источников энергии*.
9. В статье даётся краткое обобщение экспериментальных результатов исследования данной проблемы.
10. Данный материал содержит схематическое изображение предлагаемых моделей.
11. На мой взгляд, данная статья содержит много практических примеров использования предлагаемой автором установки и, следовательно, является интересной для практикующих специалистов в области *энергетики*.
12. Я считаю, что в описанные в статье исследования представляют наибольшую важность для работников сферы *энергообеспечения сельского хозяйства*.

Useful patterns for visuals

When we are giving lots of information, we often use visuals to give an overview. However, we often need to highlight only one or two key points or figures and then comment on them. Here's some language to help you.

Introducing visuals
<ul style="list-style-type: none"> • <i>I'd like you to look at this graph...</i> • <i>Let me show you this pie chart...</i> • <i>Let's have a look at this model...</i> • <i>Let's turn to this map...</i> • <i>To illustrate my point let's look at some diagrams...</i> • <i>As you can see from these figures...</i> • <i>If you look at these photographs you'll see...</i> • <i>If you look at this photo / bar / histogram / chart / matrix / flow-chart you'll notice / appreciate / understand...</i>
Describing and discussing charts and diagrams
<ul style="list-style-type: none"> • <i>This pie (bar) chart / figure / picture / diagram --- shows / presents / outlines / is about / deals with ...</i> • <i>The following table contains ...</i> • <i>The line graph (clearly) shows ...</i> • <i>The slices of the pie chart compare...</i> • <i>The chart is divided into ... parts.</i> • <i>The visuals highlight ...</i>
Comparing numbers
<ul style="list-style-type: none"> • <i>... has the (second) largest (number of) ...</i> • <i>... is (twice) as big as ...</i> • <i>... is bigger than ...</i> • <i>more than ... per cent ...</i> • <i>only one third ...</i> • <i>less than half ...</i> • <i>The number ... increases / goes up / grows by ...</i> • <i>The number ... decreases / goes down / sinks by ...</i> • <i>The number ... does not change / remains stable</i>
Making conclusions
<ul style="list-style-type: none"> • <i>A more profound examination reveals ...</i> • <i>The figures illustrate ...</i> • <i>We have no reliable figures, but it is clear that ...</i> • <i>Statistics / authoritative surveys has (have) shown / showed ...</i> • <i>A set of figures will let us assume / indicate / suppose ...</i> • <i>This example illustrates well enough / will suffice to show that ...</i> • <i>This may serve as a good example of ...</i> • <i>I was really surprised / shocked by the ...</i> • <i>So we can say ...</i>

PASSIVE VOICE

Пассивный залог (passive voice) показывает, что лицо или предмет, выраженное подлежащим, испытывает действие на себе. Пассивный залог употребляется, когда исполнитель действия очевиден или несуществен, или когда действие или его результат более интересны, чем исполнитель.

Чтобы получить форму глагола в пассивном залоге, необходим вспомогательный глагол **to be** в соответствующем времени, лице и числе и **Participle II** (3 форма) значимого глагола:

*The turbines at the hydropower station **are turned** by water, and in this way workable power **is produced**.*

INDEFINITE	Present	Am is are	driven
	Past	was were	driven
	Future	shall will	be driven
CONTINUOUS	Present	Am is are	being driven
	Past	Was were	being driven
	Future	—————	
PERFECT	Present	Have has	been driven
	Past	had	been driven
	Future	Shall will	have been driven

Модальные глаголы также могут участвовать в образовании страдательного залога: **Modal V + (to) be + Participle II** (3 форма) значимого глагола:

*The turbines at the hydropower station are turned by water, and in this way workable power **can be produced**.*

*This device **had to be fixed**.*

Learn off the following example and remember the meanings of propositions.

The devices are produced

of (from) metal

by experienced workers

with special tools.

Приборы производят

(из чего) из металла

(кто или кем) опытные рабочие

(при помощи чего или чем)

специальными инструментами.

I. Make these active sentences passive and translate them into Russian.

1. The scientist had presented two solving methods of that important problem by the early December.
2. Yesterday the engineers of our research institute carried out some important experiments in our laboratory.
3. In 1800, Volta first produced a continuous current that we still actively use today.
4. People of the Russian Federation use atomic energy mostly for peaceful purposes.
5. Any wet string can conduct electric current as it has some conductivity.
6. The resistance has considerably reduced the flow of electric current.
7. This transformer is to step down the voltage in this circuit.
8. These transmission lines will deliver power from this station to distribution centers.
9. The worker is adjusting this device in the laboratory.
10. We should widely apply solar energy to various industrial and domestic needs.

II. Complete the sentences in the Passive Voice with the verbs in brackets.

1. This new experimental line (to work out) by the specialists of our university last year.
2. Atomic energy (to use) by Russian researchers and energy specialists for peaceful purposes.
3. Complex agricultural processes (to explain) to mechanical department students at the next lecture.
4. Motors can (to use) for converting different forms of energy into mechanical energy.
5. Some experiments on the properties of semiconductors for agricultural purposes (to carry out) by the students before the last exam.
6. Now all electrical devices in our office (to operate) by the solar power for experiment.
7. At present an alternating current should (to use) in most cities for lighting, heating and other purposes.
8. Experiments on atmospheric electricity (to make) by Lomonosov and some of his scientific followers.
9. Electric energy is (to transform) into heat in the electrical appliances.
10. Heat energy (to transmit) to the point of its application in different ways in the near future.

III. Surf the Internet (you are strongly encouraged to refer to the original mass media sources and scientific reports), find 10 sentences in the Passive Voice from the power engineering field. Write them out and be ready to translate.

MODAL VERBS

ГЛАГОЛ	ЗНАЧЕНИЕ	СПОСОБ ПЕРЕВОДА	ЭКВИВАЛЕНТ-PAST	ЭКВИВАЛЕНТ-FUTURE
Can	Возможность Способность Разрешение	Могу, умею Можете (вам разрешено): <i>He can fix the car because he knows its design well.</i> <i>Can you take this instrument readings?</i> <i>You cannot drive a car without a driving license.</i>	Could, to be able to (несовершенный вид - мог): <i>Last year he could translate articles without using a dictionary.</i> To manage / fail (совершенный вид – (не) смог) <i>Last year he managed / failed to translate the text without a dictionary at the exam.</i>	To be able to: <i>After several weeks of studies you will be able to translate special texts with ease.</i>
May	1) разрешение 2) предположение	1) Могу, можно <i>You may use the instrument for your experiments.</i> 2) Возможно, может, может быть <i>They may be discussing the plan now.</i>	1) Might, to be allowed to <i>The students might use (were allowed to use) dictionaries at the exam.</i> 2) may+have+V₃ (see NOTE)	1) To be allowed to <i>You will be allowed to use only dictionaries at your English exam.</i> 2) may <i>They may discuss the plan tomorrow.</i>
Must	1) необходимость, обязательность 2) вероятность	1) должен, нужно, надо <i>He must provide us with all the necessary data.</i> 2) вероятно, должно быть, наверняка, скорее всего <i>He must be testing the device now.</i>	1) To have to; to be to <i>They were to change the delivery schedule at the last meeting as they had settled. (по договоренности)</i> <i>They had to change the delivery schedule as it didn't suit them. (под воздействием обстоятельств)</i> 2) must+have+V₃ (see NOTE)	1) To have to; to be to <i>He was to provide us with all the information on this device operation according to the sale-purchase agreement.</i> 2) to be likely to, to be certain to <i>He is certain to fix the device tomorrow.</i>
OTHER VERBS			EXAMPLES	
Should, ought to	Моральный долг, совет, необходимые действия (в инструкциях)	Должен / Следует Сделайте (глагол в повелительном наклонении)	<i>You ought to be careful when working with high voltage.</i> <i>These machines should be handled with great care.</i>	

NOTE: Перевод модальных глаголов с перфектным инфинитивом.

May, must	предположение, относящееся к ПРОШЛОМУ	Could, should, might, ought to	действие могло бы произойти, но не произошло
<p><i>They must have completed the work.</i> (должно быть, вероятно) <i>They may have repaired the device but we don't know it for sure.</i> (возможно, может быть)</p>		<p><i>You could have done the work yourself.</i> <i>They should have tested the new equipment.</i></p>	

I. Translate the following sentences into Russian.

1. Coal and other fuels may be replaced by atomic energy sometime in the near future.
2. The power station was to supply us with all necessary energy, but it could hardly do that.
3. The energy of falling water can be used to drive turbines and produce electric current.
4. We should employ solar energy directly to produce useful electric energy and heat.
5. Wind and tide stations will be able to produce cheap electric energy in the near future.
6. You may have got little electric shock by touching bare wires of a faulty apparatus.
7. The engineer must have good knowledge of technical characteristics for various electronic devices.
8. Electric power has to be transmitted over large distances, which is most economically accomplished by high voltage current.
9. Those substations must have served as transformer substations for agricultural purposes.
10. Due to a transformer, electric energy may be changed at a very high voltage.

II. Refer the following sentences to the past using could, had to, was to, was allowed to. Don't forget to make all the necessary changes.

1. This electrical circuit can be used to control some other schemes.

2. The students may take any device they like so that to measure the required parameter.
3. My friend lives a long way from his institute and he has to get up very early in the morning.
4. Due to the energy of the atom men can produce electric energy at atomic power stations.
5. An electronic machine must be used to make all these calculations and technical drawing.
6. They must help their friend to solve this vital problem as soon as it can be possible.
7. He cannot complete his research in time as he must work very carefully.
8. The students cannot do the work without their teacher's help; he must help them.
9. As the student is late for his Soil Science class, he may not enter the classroom.
10. Our Samara plant must increase the output of refrigerators by 25 per cent monthly.

III. Surf the Internet (you are strongly encouraged to refer to the original mass media sources and scientific reports), find 10 sentences from the power engineering field with modal verbs in different functions and in different tense contexts. Write them out and be ready to translate.

CONDITIONALS

Условные предложения в английском языке также называют «*If-sentences*». Условное предложение состоит из двух частей, первая из которых (придаточная) начинается со слова «*если – if*» и содержит условие, а вторая (главная) часть содержит такие слова как *will, can, may, might, could, would* и выражает действие, которое может (типы 0 и 1) или могло **БЫ** (типы 2, 3 и смешанные) иметь место.

Виды условных предложений	Использование	В придаточном предложении (if)	В главном предложении
Тип 0	Описываются события, явления, вещи, которые являются истиной, фактом (научным, общеизвестным), они реальны .	Present Simple	Present Simple
	<i>If a liquid is heated, it usually expands.</i>		
Тип 1	Описываются события будущего времени, они реальны и возможны .	Present Simple	Future Simple
	<i>If a liquid is heated, it will expand.</i>		
Тип 2	Описываются события, относящиеся к настоящему или будущему, но они нереальны .	Past Simple	Would + V1
	<i>If this liquid were heated now, it would expand.</i>		
Тип 3	Описываются события, относящиеся к прошедшему времени, они могли произойти, но не произошли.	Past Perfect	Would have + V3
	<i>If this liquid had been heated during that experiment, it would have expanded.</i>		
Смешанный тип 1	Условие относится к прошлому (Тип 3), а следствие к настоящему времени (Тип 2).	Past Perfect	Would + V1
	<i>If this liquid had been heated during that experiment, you would know that it expands.</i>		
Смешанный тип 2	Условие НЕ относится к конкретному времени (Тип 2), а следствие относится к прошлому (Тип 3)	Past Simple	Would have + V3
	<i>If it were possible to heat this liquid many times, it would have evaporated.</i>		

I. Practice to use conditional sentences of types 1, 2 and 3.

1. If a person touches a live conductor, it results in an electric shock.

2. Practical workers of power generating and distributing industry are not able to obtain good results if new devices are not applied.
3. Electrical devices work for a longer time if they are made of higher-quality materials.
4. If the conductor is very thin while the current is large, the amount of generated heat is much greater than that produced in a thick wire.
5. If we test any material, we can use it in our research.

II. Match the two sentence parts to form complete sentences.

1. If atomic energy replaces the present-day sources of energy,	1. we should get more valuable products of its recycling or decrease environmental pollution in the most developed coal-producing sites.
2. If they had introduced these safety devices,	2. they get better results.
3. If coal were not used as a common fuel for power-producing installations,	3. we would have completed our work long ago.
4. If the scientists apply new methods,	4. the fast development of radio engineering, automatics, chemistry, electronics and many other fields of modern science and technology would be impossible.
5. If the properties of semiconductors hadn't been discovered,	5. they would not have had any troubles with the equipment.
6. If the checking up of the experimental data did not take so much time,	6. we shall get times more energy as compared to the level of production that we boast today.

III. Fill in the gaps with the correct forms of the verbs in brackets.

1. If a color television receiver is tuned to the frequency of the monochrome transmitter, it (to reproduce) monochrome transmissions.
2. If the current (to flow) through the copper wire wound around an iron core, the iron would turn into the magnet.
3. If the same quantity of electricity (to pass) through different electrolytes, the weights of liberated substances will be in the ratio of their equivalent weights.
4. If Ampere hadn't paid attention to Oerstaed's experiments, he (not to discover) the law we know now as Ampere's rule.
5. If the alternating current (to be applied) to the cathode, the tube conducts only during one half of each cycle, i.e. while the cathode is negative and the anode is positive.

6. If the chain reaction speeds up, the cadmium rods (to be inserted) into the midst of the fission process and (to slow) it down absorbing neutrons.
7. If they had used a larger water pipe for their last experiment, they (to know) now that more heat would have been withdrawn from the transformer.
8. If professor Rihman (to think) of the possible extreme dangers resulting from his experiments, lightning would not have killed him, and he could have made lots of new discoveries.
9. If the sky (to be) the limit for humankind's innate curiosity, people wouldn't have started the exploration of it in its infancy.
10. If some current flowed along a thin wire and then the same amount of current were sent through a thicker one, a different amount of heat (to develop) in both wires.

IV. Surf the Internet (you are strongly encouraged to refer to the original mass media sources and scientific reports), find 10 conditional sentences from the power engineering field. Write them out and be ready to translate.

ИНФИНИТИВ (THE INFINITIVE)

Инфинитив, или неопределенная форма глагола, отвечает на вопрос *что делать?* или *что сделать?* Показателем инфинитива является частица **to**.

Indefinite	<i>Active</i>	<i>Passive</i>	Выражают действия, одновременные с действием глагола-сказуемого.
	to write	to be written	
Continuous	to be writing	—	Выражают действия, предшествующие действию глагола-сказуемого, и переводятся прошедшим временем.
Perfect	to have written	to have been written	
Perfect Continuous	to have been writing	—	

Функции в предложении:

Подлежащее	<p>Переводится существительным или неопределенной формой глагола: <i>To repair the device was rather difficult.</i></p> <p>Признаком инфинитива-подлежащего является его положение в начале предложения перед сказуемым и отсутствие другого слова, являющегося подлежащим.</p>
Часть сказуемого	<p>а) составного глагольного (переводится неопределенной формой глагола): <i>This engineer is to design a new device.</i></p> <p>б) именной частью сказуемого после подлежащего, выраженного словами aim, purpose, duty task, method, wish, plan, function, problem и др., и глагола-связки to be, причем глагол-связка либо совсем не переводится на русский язык, либо переводится словами <i>заключаться в том, что(бы); состоять в том, чтобы</i>: <i>Your task is to repair the device.</i> <u>Сравните:</u> <i>They were to install the new equipment.</i> <i>Our task was to install the new equipment in time.</i></p>
Дополнение	<p>Переводится неопределенной формой глагола: <i>We hope to get new data in a week or two.</i></p>
Определение	<p>Всегда стоит после определяемого существительного и переводится:</p> <p>а) определительным придаточным предложением, сказуемое которого выражает долженствование, возможность или будущее время;</p> <p>б) существительным;</p> <p>в) неопределенной формой глагола: <i>The device to be tested is of a very high quality.</i> <i>The idea to use this new material didn't leave us.</i></p> <p>Инфинитив после слов the first (the second, the third, the last etc.) тоже является определением и переводится на русский язык глаголом в том времени, в котором стоит глагол to be: <i>These tests were the last to be undergone by the device before being put into mass production.</i></p>

Обстоятельство	<p>а) цели. Стоит в начале предложения перед подлежащим или в конце предложения. Иногда вводится союзом in order to для того чтобы. Переводится на русский язык неопределенной формой глагола с союзом <i>чтобы, для того чтобы</i> или существительным с предлогом <i>для</i>: To repair the device one should know its construction and operation.</p> <p>б) следствия (со словами too, enough перед инфинитивом), часто при переводе имеет модальный оттенок: <i>This metal is too brittle to be used in our case.</i></p>
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I. Translate the following sentences into Russian.

1. One of the main tasks for engineers to decide before beginning to construct any transmission line is to evaluate its environmental impacts.
2. To generate electricity, dynamos – generators and alternators – must be provided with energy from some sources of mechanical energy.
3. At least 90 per cent of electric energy to be generated at present is alternating current, although there are many cases when direct current is required.
4. The electricity to be obtained by rubbing objects is too negligible to light lamps, to boil water, to run electric trains, and so on.
5. Franklin was the first to prove that unlike charges were produced due to rubbing objects which were dissimilar in texture.
6. To generalize and reconfirm the effect obtained with one pair of metals, Volta - the first man to get the electric current - increased the number of these pairs.
7. To achieve the quick and steady increase in power production is highly important for today.
8. There were some attempts to weigh a single particle of electricity and to calculate its electric charge.
9. He proved to be the first scientist who suggested the idea of dividing electricity into positive and negative electricity.
10. It is known that a signal to be utilized in daytime should be substituted by colored lights at night.

II. Join the sentences using infinitives and translate them into Russian.

1. In his early youth, Faraday had to save money. It was necessary to buy the apparatuses and instruments for his experiments.
2. Humphrey Davy, an outstanding British scientist and the most popular lecturer in London, helped Faraday. The latter became an assistant at the laboratory of the Royal Institute.
3. A fuse is a very important device. It prevents an excessive current from passing through the circuit.
4. The excessive current increases the temperature of the wire. It can melt it and break the circuit. (Make use of *enough*.)
5. Edison made a series of experiments. He wanted to improve the incandescent filament lamp.
6. The calibration is a graduation of any instrument. It is undertaken in order to enable measurements in definite units.
7. It is necessary to reduce the current flowing through conductors. It will decrease power loss in the line.
8. Professor Vladimir Petrov was a scientist. He studied the electrification of metals by rubbing them. (Make use of *the first*.)
9. Benjamin Franklin liked to make experiments during thunderstorms. It was his hobby.
10. The generator is a special electrical device. It changes mechanical energy into electrical energy.

III. Surf the Internet (you are strongly encouraged to refer to the original mass media sources and scientific reports), find 10 sentences from the power engineering field with the infinitives in different functions. Write them out and be ready to translate.

COMPLEX OBJECT AND COMPLEX SUBJECT COMPARED

Образование Complex Object

Подлежащее	Сказуемое	Дополнение (существительное в именительном падеже или местоимение в объектном падеже)	Инфинитив (или причастие I)
<i>We</i>	<i>expected</i>	<i>them</i>	<i>to begin the experiment.</i>

Образование Complex Subject

Подлежащее (существительное или местоимение в именительном падеже)	Сказуемое (часто в страдательном залоге)	Инфинитив	Другие члены предложения
<i>He</i>	<i>is known</i>	<i>to work</i>	<i>hard.</i>

Разница между Complex Object и Complex Subject

Случаи употребления	Complex Object	Complex Subject
после глаголов, выражающих желание (<i>to want, to wish, to like</i>)	<i>I wanted him to start the experiment.</i>	Не употребляется
после глаголов, выражающих предположение (<i>to believe, to expect, to declare, to suppose</i>)	<i>I believe him to be a very good engineer.</i> (сказуемое выражено глаголом в Present Simple Tense) <i>I expected her to arrive on time.</i> (сказуемое выражено глаголом в Past Simple Tense)	<i>He is believed to be a very good engineer.</i> (сказуемое выражено глаголом в страдательном залоге в настоящем времени) <i>She was expected to arrive on time.</i> (сказуемое выражено глаголом в страдательном залоге в прошедшем времени)
после глаголов, выражающих восприятие посредством органов чувств (<i>to see, to notice, to feel</i>)	<i>We heard him start the motor.</i> (после глагола чувственного восприятия инфинитив употреблен без частицы <i>to</i>)	<i>He was heard to start the motor.</i> (после глагола чувственного восприятия в страдательном залоге инфинитив употребляется с частицей <i>to</i>)
после глаголов, выражающих просьбу, приказ, разрешение (<i>to ask, to allow, to order</i>)	<i>He asked for the instruction to be sent off immediately.</i> (сказуемое выражено глаголом в Past Simple Tense)	<i>He was asked to send the instruction.</i> (сказуемое выражено глаголом в страдательном залоге в прошедшем времени)
после глаголов <i>make</i> (в значении заставлять) и <i>let</i>	<i>The engineer made the worker start the experiment.</i> (после глагола <i>make</i> инфинитив употреблен без частицы <i>to</i>)	<i>The worker was made to start the experiment.</i> (после глагола <i>make</i> в страдательном залоге инфинитив употребляется с частицей <i>to</i>)
после глаголов <i>to seem, to appear, to prove, to happen</i>	Не употребляется	<i>He seems to know English well.</i> (глаголы этой группы)

		употребляются в действительном залоге)
когда сказуемое выражено глаголом-связкой <i>to be</i> со следующими прилагательными: <i>likely, unlikely, certain</i>	Не употребляется	<i>He is likely to know the results of the experiment.</i>

I. Translate the following sentences into Russian.

1. The invention of an electronic tube by Thomas Edison in 1883 is stated to give birth to the modern electronic industry.
2. Everybody believed the lightning rod invented by Benjamin Franklin to be the most efficient means of protection against the effects of lightning.
3. Scientists found out electricity to be made of tiny particles that they tried to separate in order to weigh a single particle of electricity and to calculate its electric charge.
4. A fuse is known to include a wire made of metal with low melting point, which is heated sufficiently to melt by the excessive current passing through the circuit and, thus, breaks the circuit.
5. The earthening systems are expected to protect attending personnel from electric shocks when voltage appears on parts that are normally dead.
6. The temperature is reported to influence the conductivity of conductors to a little extent, while that of semiconductors increases sharply with heating and falls with cooling.
7. The overloading of the power transmission line is likely to produce a short circuit dangerous for both attending personnel and other elements of the circuit.
8. Under the existing conditions, the industrial utilization of this type of generators made them suffer some trouble.

9. A mechanical water driven power generating device is said to be a much simpler device than a turbo-generator that combines the functions of both a steam turbine and an electrical generator.
10. Heat is known to be a form of thermal energy used for industrial and domestic heating purposes and certain agricultural needs.

II. Join the sentences using Complex Object / Complex Subject and translate them.

1. They were talking about some attempts to weigh a single particle of electricity and to calculate its electric charge. He heard them.
2. He solved at last the problem of cheap illumination on a large scale having employed a durable carbonized filament. It was reported in the newspaper.
3. He was the first scientist who suggested the idea of dividing electricity into positive and negative electricity. It happened so.
4. A signal which is used in daytime is substituted by colored lights at night. It is a known fact.
5. One of the main tasks for engineers to decide before the construction of the transmission line was to evaluate its environmental impacts. The director of the project ordered it.
6. The efficiency of electric locomotives is much higher than that of steam locomotives. All the engineers believe it.
7. An electric arc is a discharge accompanied by a temperature of over 3,000 °C, produced when the electric current flows through a gap between two electrodes. We supposed it.

8. The quantity of heat produced is proportional to the resistance of the conductor when the electric current flows through it. It was declared.
9. More atomic power plants should be built for producing electric energy in many countries of the world because of their high efficiency and low expenses. Everybody wants it.
10. The students turned their attention to the problems of semiconductors and their wider application. Our university professor lecturing on power engineering made them do it.

III. Surf the Internet (you are strongly encouraged to refer to the original mass media sources and scientific reports), find 10 sentences from the power engineering field with complex objects and complex subjects in different situations. Write them out and be ready to translate.

THE GERUND AND PARTICIPLE I COMPARED

<p>Причастие – неличная форма глагола, обладающая свойствами прилагательного и глагола.</p>	<p>Герундий – неличная форма глагола, обладающая свойствами существительного и глагола и выражающая процесс действия.</p> <p>Характерные признаки: наличие перед ним</p> <ul style="list-style-type: none"> ▪ предлога ▪ притяжательного местоимения ▪ существительного в притяжательном или общем падеже
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Функции Причастия I	Функции Герундия
<p>1. определение: а) левое – <i>an operating motor</i> б) правое – <i>an engineer operating a motor</i> <i>The plant producing electricity is very powerful.</i></p>	<p>1. определение (прилагат. или сущ.): <i>an operating principle = a principle of operating</i> <i>a reading hall = a hall for reading</i> <i>There are several ways of producing electricity.</i></p>
<p>2. обстоятельство времени: (While / when) <i>Testing the motor he noticed some troubles.</i> (*) Можем менять части местами. Перевод: а) деепричастием (оборотом); б) придаточным предложением с союзом <i>когда, в то время как</i>; в) <i>при</i> + существительное</p>	<p>2. обстоятельство (всегда с предлогом: in, on(upon), before/after, without): <i>After testing the motor they put down the results.</i> Перевод зависит от используемого предлога: In (деепричастие настоящ.; <i>при</i> + сущ.) On/upon (деепричастие прош.; <i>при/после</i> + сущ.) Before/after (<i>до/после</i>+сущ.; прид.обст.<i>до того как</i>) By (деепричастие наст.; <i>путем/с помощью</i> + сущ.) Without (не + деепричастие; без + существительное)</p>
<p>3. часть сказуемого (Cont. / Perf.-Cont.): <i>The designers are applying the most progressive methods of constructing nowadays.</i></p>	<p>3. часть сказуемого: <i>The electrician's task (duty, aim etc.) is checking the wire.</i></p>
<p>---</p>	<p>4. подлежащее: <i>Testing the motor was necessary.</i></p>
<p>---</p>	<p>5. дополнение: а) прямое: <i>I like (your) reading (the text).</i> б) косвенное: <i>We heard of his going to London.</i> <i>We know of copper and silver being the best conductors.</i> Перевод придаточным: мы знаем о том, что</p>

THE VERBAL NOUN

<p>Образуется путем прибавления к форме инфинитива суффикса-окончания – ing.</p>	<p>В отличие от герундия, отглагольное существительное обладает только свойствами существительного</p>
<p><i>to meet</i> (встречать) — <i>a meeting</i> (встреча, собрание, митинг)</p>	<p>1) употребляется с артиклем, 2) может иметь форму множественного числа, 3) может определяться прилагательным: <i>The readings of this device are correct.</i></p>

I. Translate the following sentences into Russian.

1. A good example illustrating an important industrial use of the electric current is the electrically heated furnace in which great masses of metal are melted and flow just like water.
2. An instrument connected to an electric circuit and measuring the power delivered to the circuit is a wattmeter.
3. Being widely used in industry, electrical motors and power generators are also used in every domestic practice including inner and outer lighting and in-house heating purposes.
4. Learning to protect the houses from thunderstorms was a very important task and it led to the invention of the lightning conductor by Benjamin Franklin.
5. Making this instrument designed to take temperature, we could hardly do without a machine operated by electricity.
6. One of the problems modern research laboratories are working on is that of finding materials that can serve as electrical conductors in fusion reactors.
7. Russian scientists played an important part in solving the problem of atmospheric electricity.
8. The construction of power stations operating on atomic fuel and generating electric current is quite necessary.
9. What is the name of the insulating material capable of being subjected to an electric stress?
10. Working at his new device the power engineer made numerous experiments till he got the results obtained.

II. Change the following sentences using the Gerunds, Participles I and the verbal nouns.

1. Edison made a series of experiments when he worked on the improvement of the incandescent filament lamp.

2. The temperature of hot metals which flow is often measured by the electric pyrometer.
3. Being widely used in industry, electrical motors and power generators are also used in every domestic practice; they light and heat houses.
4. The pyrometer which shows the temperature of metals melted in furnaces is an electrical device.
5. It was impossible to protect houses and public buildings from strokes of lightning before Faraday's time.
6. The construction of power stations which will operate on atomic fuel and generate electric current is quite necessary.
7. The lightning conductor is a metal device to protect buildings from strokes of lightning; it conducts electric charges to the earth.
8. Now everybody knows that lightning is a very great flash of light. It results from a discharge of atmospheric electricity either between a charged cloud and the earth or between charged clouds.
9. The inventor did not want to change the construction of the electric measuring device. (Use made of *to be against*).
10. The generator is a special electrical device which changes mechanical energy into electrical energy.

III. Surf the Internet (you are strongly encouraged to refer to the original mass media sources and scientific reports), find 10 sentences from the power engineering field where the Gerunds, Participles I and the verbal nouns are used. Write them out and be ready to translate.

Учебное издание

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**DISCUSSING POWER ENGINEERING ISSUES
IN THE ACADEMIC CONTEXT**
(Английский язык для научно-исследовательской деятельности)

Учебное пособие

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