

**НАВЧАЛЬНО-НАУКОВИЙ ЦЕНТР ГУМАНІТАРНОЇ ОСВІТИ**

**Кафедра іноземних мов**

**ТЕПЛОЕНЕРГЕТИЧНІ УСТАНОВКИ**

**МЕТОДИЧНІ ВКАЗІВКИ**

**з розвитку навичок читання та комунікативної компетенції  
для студентів 2 курсу механічного факультету**

**(англійська мова)**

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Основна мета методичних вказівок – подальший розвиток усного мовлення, систематизація та розширення словникового запасу з теми «Теплоенергетичні установки» і подальший розвиток усного спілкування. Вправи націлені на засвоєння лексичного матеріалу, набуття міцних навичок за всіма видами мовної діяльності.

Методичні вказівки призначені для студентів 2-го курсу механічного факультету.

Укладачі:

викладачі О.А. Дзюба, І.О. Печій

Рецензент

доц. С.М. Донець

## ТЕПЛОЕНЕРГЕТИЧНІ УСТАНОВКИ

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Відповідальний за випуск Дзюба О.А.

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# УКРАЇНСЬКА ДЕРЖАВНА АКАДЕМІЯ ЗАЛІЗНИЧНОГО ТРАНСПОРТУ

НАВЧАЛЬНО-НАУКОВИЙ ЦЕНТР ГУМАНІТАРНОЇ ОСВІТИ  
Кафедра “Іноземні мови”

## МЕТОДИЧНІ ВКАЗІВКИ

«Теплоенергетичні установки»  
з розвитку навичок читання та комунікативної компетенції для  
студентів 2 курсу механічного факультету

(англійська мова)

автор:

зав. кафедри:

директор ННЦГО:

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## UNIT 1

**Exercise 1. Read the following words, word-combinations and their Ukrainian equivalents. Repeat them after the teacher. Try to memorize them.**

**closed vessel** – закрита посудина  
**device** – пристрій  
**to generate steam** – створювати пар  
**furnace, burner** – піч, топка  
**to burn a fuel** – спалювати паливо  
**under pressure** – під тиском  
**fire-tube boiler** – жаротрубний котел  
**water-tube boiler** – водотрубний котел  
**to circulate** – циркулювати  
**continuous circuits** – безперервний ланцюг  
**to prevent explosions** – запобігати вибухам  
**safety valve** – запобіжний клапан  
**tank of water** – бак з водою  
**thermal conduction** – теплопровідність  
**combustion gases** – гази згоряння  
**rear of the boiler** – задня частина котла  
**flow of steam** – потік пари  
**circulation** – кругообіг, циркуляція  
**downcomer** – циркуляційна труба  
**to repeat the cycle** – повторити цикл  
**flash boiler** – котел зі швидкою розчиненою парою  
**to pump water** – накачувати воду  
**less bulky** – менш об'ємний  
**prone to** – схильний до  
**tubeless boiler** – безкамерний котел  
**package boiler** – транспортабельний котел  
**mounted on a skid** – встановлений на платформу  
**to become operational** – вступати в силу

**Exercise 2. Translate the following expressions.**

A closed vessel in which is heated, to be used for generating steam, to consist of, under pressure in a boiler, in these continuous circuits, to prevent explosions by releasing steam, to use a safety valve, a tank of water penetrated by pipes, combustion gases pass

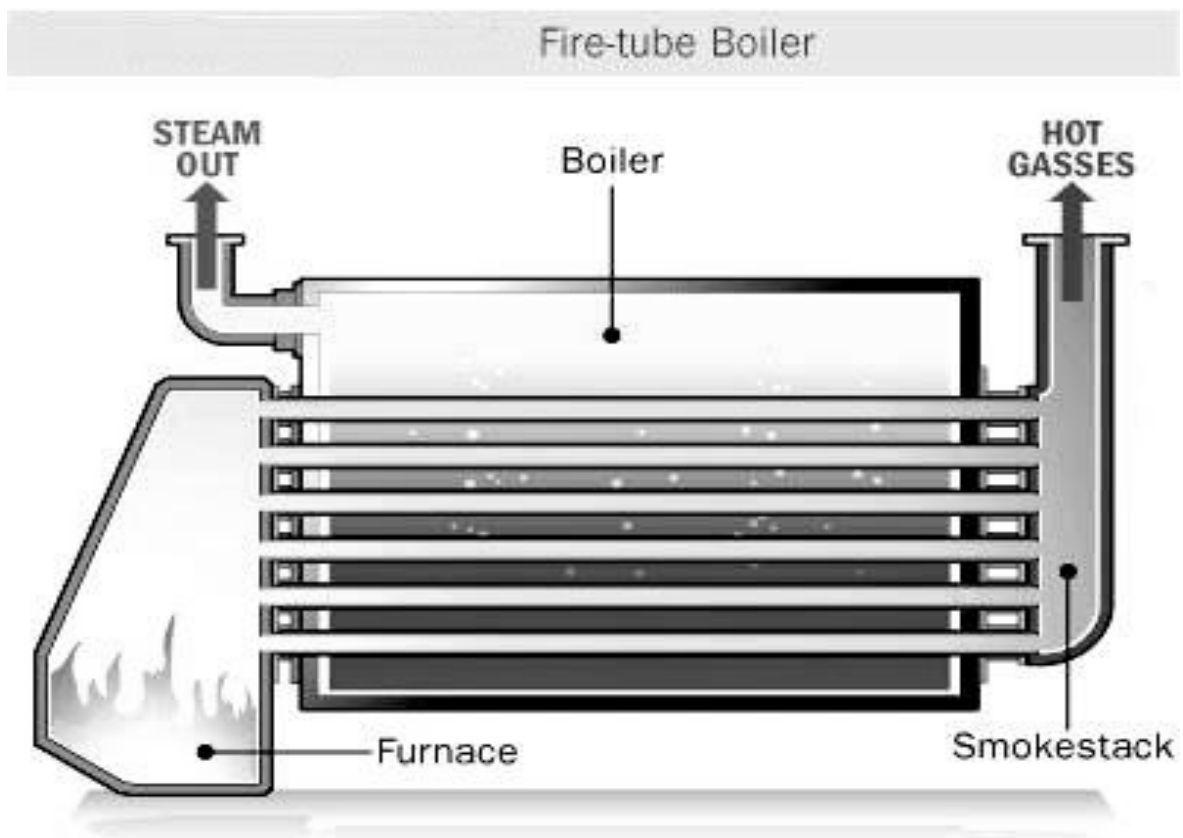
through, flow through the downcomers, have water pumped through tubes, less bulky than other types, more prone to overheat, boilers which are mounted on a skid, make a boiler to become operational.

## **Boilers**

A boiler is a closed vessel in which water or other liquid is heated. It is used for generating steam and consists of the furnace and the boiler proper. The furnace provides heat, usually by burning a fuel. The boiler is a device in which the heat changes water into steam. A steam engine is driven by steam generated under pressure in a boiler. The amount of steam that can be generated per hour depends upon the rate of combustion of the fuel in the furnace and upon the efficiency of heat transfer to the boiler proper.

There are two common types of boilers: fire-tube boilers and water-tube boilers. The former contains long steel tubes through which the hot gases from the furnace pass and around which the water to be changed to steam circulates. In the latter the conditions are reversed. In these continuous circuits water is changed to steam and it is super-heated in transit. To prevent explosions by releasing steam if the pressure becomes too great the safety valve is used.

*Fire-tube boiler* is a tank of water penetrated by pipes that carry the hot [flue gases](#) from the fire. The heat of the gases is transferred through the walls of the pipes by thermal conduction, heating the water and ultimately creating steam. In a fire-tube boiler, combustion takes place within a cylindrical furnace located within the boiler and combustion gases pass through tubes surrounded by water. The combustion gases leave the furnace through the rear of the boiler, then reverse direction and pass through the boiler tubes several times, increasing the amount of heat transfer. This cylindrical shape may be either horizontal or vertical. A vertical fire-tube boiler is a vertical boiler where the heating surface is composed of multiple small fire-tubes, arranged vertically. Horizontal boiler has a horizontal cylindrical shell, containing several horizontal flue tubes, with the fire located directly below the boiler's shell. Fire-tube boilers typically have low initial costs and are more fuel efficient but they are limited generally to capacities.

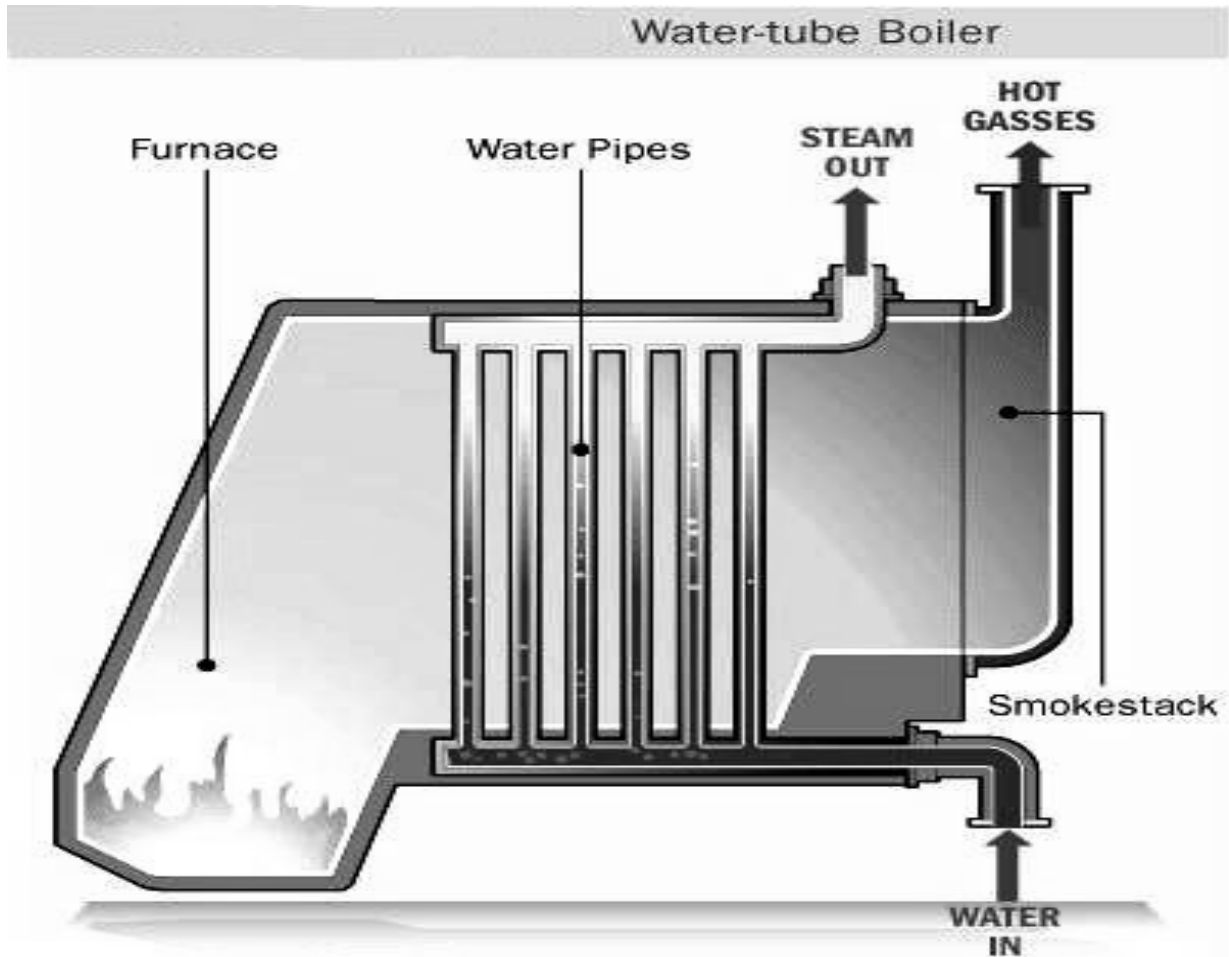


*Water-tube boilers* are boilers for generating steam by passing water in tubes through flames and hot. In water-tube boilers, water is converted to steam inside the tubes, while hot gases pass over and around the outside of the tubes. Water-tube boilers can operate at higher pressure than fire-tube boilers. The flow of steam and water within a water tube boiler is called circulation. This circulation is critical in preventing tubes from overheating. The resulting steam and water mixture is lighter than cooler water on the unheated side of the boiler, and rises to a steam drum at the top of the boiler. Here the bubbles rise to the surface and steam is released. The water then flows from the drum down through the downcomers (cooler tubes), completing and repeating the cycle. A water-tube boiler can work on almost any solid, liquid or gaseous fuel.

Fuel is burned inside the furnace, creating hot gas which heats water in the steam-generating tubes. However, one must mention that according to these fuels boilers have different designs.

There are some other types of boilers that are used to produce steam or hot water.





A **flash boiler** is a type of the water-tube boiler. The tubes are close together and have water pumped through them. They are kept so hot that the water feed is quickly flashed into steam and superheated. The flash boiler was invented by Léon Serpollet, who used the design in his steam-powered cars. Flash boilers are lighter and less bulky than other types, and take less time to raise steam from a cold start. On the other hand they are more prone to overheat, because there is no large reservoir to cool the tubes if the water flow is interrupted or inadequate.

**Tubeless boilers.** In these boilers water is located between the shells. Combustion gases are fired into the inner vessel where the heat is transferred to water located between the outside surface of the inner shell and the inside surface of the outer shell. The burner is usually located at the bottom of the boiler.

**Package boilers** are assembled at the plant, mounted on a skid and transported to a necessary site as one unit. Package boilers require less fuel and electric power for operation. They are widely used in different industries. Once delivered to the destination, they need only

the steam, water pipe work, fuel supply and electrical connections to make it to become operational.

**Exercise 3. Work in pairs. Answer the following questions:**

- 1 Give the definition to the word *boiler*.
- 2 What is a boiler used for?
- 3 What does a boiler consist of?
- 4 How does the furnace provide heat?
- 5 What does the amount of steam that can be generated per hour depend upon?
- 6 What two common types of boilers do you know?
- 7 What is used to prevent explosions if the pressure in the boiler becomes too great?
- 8 What is a fire-tube boiler and how does it work?
- 9 What shape may a fire-tube boiler be?
- 10 How can you characterize a water-tube boiler and its operation?
- 11 What type of boilers can operate at higher pressure?
- 12 Does a water-tube boiler need a special kind of fuel?
- 13 What is circulation?
- 14 Are there any other types of boilers? What are they?
- 15 Who was the flash boiler invented by?

**Exercise 4. Complete the sentences according to the information in the text:**

- 1 A steam engine is driven by .....
- 2 ..... contains long steel tubes through which the hot gases from ..... pass and around which the water to be changed to steam circulates.
- 3 Safety valve is used to .....
- 4 In a fire tube boiler the combustion gases leave the furnace through .....
- 5 A water-tube boiler can work on .....
- 6 Package boilers require .....

**Exercise 5. Choose the right word according to the meaning.**

1 The furnace *provides/ensure* heat, usually by *burning /injecting* a fuel.

2 A steam engine is *driven/drawn* by steam generated under pressure in a boiler.

3 To *prevent /warn* explosions by releasing steam if the pressure becomes too great the safety valve is used.

4 The heat of the gases is *transferred/hand* over through the walls of the pipes by thermal conduction, etc.

5 The combustion gases *leave /enter* the furnace through the rear of the boiler.

6 Fire-tube boilers typically *have /owns* low initial costs.

7 In a steam drum the bubbles *rise/decrease* to the surface and steam is released.

8 The burner is usually *located /founded* at the bottom of the boiler.

9 Package boilers are *assembled /collected* at the plant.

### **Exercise 6. Express the same in English.**

Мати декілька пристроїв, складатися з топки та котла, кількість пари, відсоток згоряння палива, довгі сталеві труби, задня частина котла, горизонтальна циліндрична оболонка, низькі початкові витрати, працювати при високому тиску, ненагріта сторона котла, підніматися на поверхню, протікати з барабана, повторювати цикл, працювати на будь-якому твердому або рідкому паливі, тримати дуже гарячими, охолоджувати труби, бути розташованими між, зовнішня поверхня, на дні котла, складений на заводі, постачання палива.

### **Exercise 7. Write an annotation to the text “Boilers”.**

## **UNIT 2**

**Exercise 1. Read the following words, word-combinations and their Ukrainian equivalents. Repeat them after the teacher. Try to memorize them.**

**a rotary engine** – ротаційна машина

**to extract and convert the energy** – здобувати та перетворювати енергію

**generation of electricity** – вироблення електрики  
**for many purposes** – для багатьох цілей  
**to propel ( syn. to drive)** – приводити до руху  
**to concern** – стосуватися  
**a large wheel** – велике колесо  
**blade** – лопать (syn. **airfoil**) , **fixed blades** – нерухомі лопаті,  
**moving blades** – рухомі лопаті  
**rim** – обід  
**rotor** – робоче колесо  
**to impart** – наділяти, передавати (рух)  
**casing** – корпус  
**nozzle** – сопло  
**fluid flow** – потік рідини  
**relative velocity** – відносна швидкість, **an increase in velocity**  
 – збільшення у швидкості  
**reaction turbine** – реактивна турбіна  
**impulse turbine** – активна турбіна  
**impact** – поштовх, удар  
**a shaft** – вал, **to cause the shaft to rotate** – примусити вал  
 обертатись  
**decrease in pressure** – зменшення у тиску  
**to drive electric generator** – приводити в дію  
 електрогенератор  
**bucket** – ковш  
**gas turbine-electric locomotive** – газотурбовіз з  
 електропередачею  
**combustion chamber** – камера згоряння  
**to resemble** – нагадувати, бути схожим на  
**wind turbine** – повітряний генератор  
**to deflect** – відхилятися, змінювати напрямок

## **Exercise 2. Translate the following expressions.**

To extract energy from fluid, to convert energy into work, to  
 propel turbine, to generate electricity, to have fixed blades, to pass  
 through nozzles, to rise a relative velocity, to strike (impulse) against  
 the moving blades, of the same shape, to be fastened to the casing, to  
 drop in pressure, to act as nozzles, to give a motion to the rotor, to

resemble a steam turbine, to drive the compressor, to deflect at an angle.

## **Turbines**

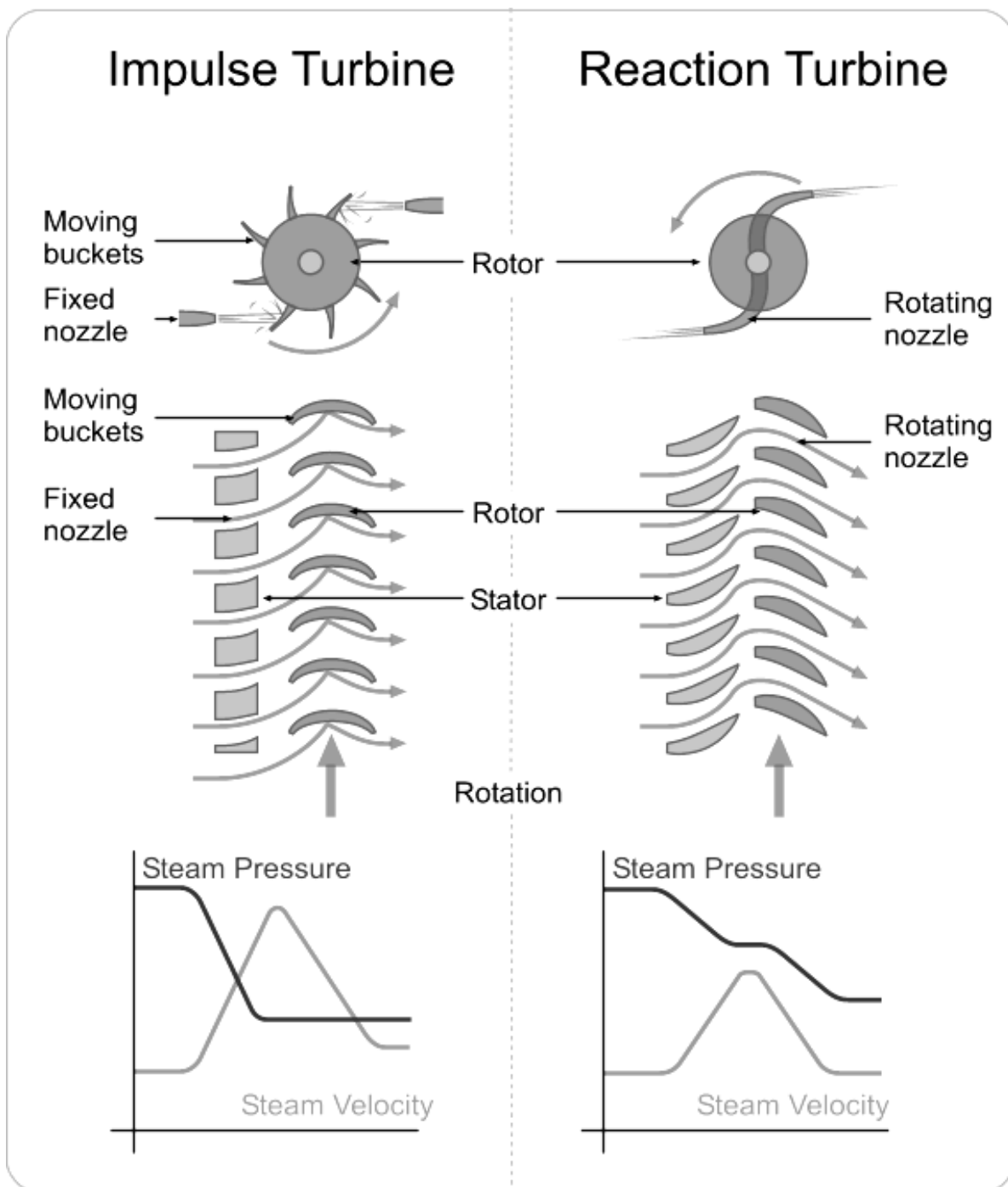
Turbine is a rotary engine that extracts energy from a moving fluid and converts it into useful work. Turbines can be classified into four general types according to the fluids used: water, steam, wind, and gas. The application of the first three has a great importance for generation of electricity; gas turbines are most often used in aircraft. The most useful turbines for many purposes are those that can be propelled with energy from heat. A typical turbine based on heat is the steam turbine.

*The steam turbine* is one of the most important inventions in the world, as far as engineering is concerned. They effectively generate electricity which can be used to perform a wide range of tasks. A turbine looks like a large wheel with many small radiating blades around its rim. It usually consists of a *rotor* carrying moving blades (or buckets), a *casing* in which the rotor revolves, and stationary *nozzles* for steam to pass through. Moving fluid acts on the blades so that they move and impart rotational energy to the rotor.

Several physical principles are employed by turbines to collect the energy. These are the **impulse** principle and the **reaction** principle. Both methods convert the thermal energy stored in the steam into useful work, but they differ somewhat in the way they do it. If the fluid flow in the blade passage is accompanied by a pressure drop and a relative velocity rise, the turbine is called a reaction turbine; if the fluid moves without a pressure drop in the blade passages, it is called an impulse turbine.

### *Impulse turbines*

The term impulse means the force that turns the turbine comes from the impact of the steam on the blades. The impulse turbine has a rotor a shaft, blades and nozzles. A stream of fluid reaches stationary passages called fixed nozzles. Here the expansion of steam takes place with a decrease in pressure and an increase in velocity. In this process the potential energy of the steam is converted into kinetic energy.



Then the steam strikes (impulses) against the moving blades causing the shaft to rotate and do mechanical work. No expansion takes place as the steam flows through the blades. The velocity attained in a properly designed nozzle depends upon the pressure drop through it.

### ***Reaction turbines***

A reaction turbine also rotates its blades, but the steam does not strike the blades perpendicular, as in an impulse turbine. In fact there are no nozzles as such. Instead, the blades are formed and mounted so that the spaces between the blades have, in cross section, the shape of

nozzles. Since these blades are mounted on the revolving rotor, they are called moving blades. Fixed blades are of the same shape as the moving blades and fastened to the casing in which the rotor revolves. So, in case of reaction turbine the steam drops in pressure and at the same time expands as it passes across both the moving blades and the stationary blades. In other words, both moving and fixed blades act as nozzles. In fact it is this drop in pressure that gives a reaction and hence motion to the rotor.

*A water, or hydraulic, turbine* is a rotary engine that takes energy from moving water. It is used to drive electric generators in hydroelectric power stations. In a hydraulic turbine falling water strikes a series of blades or buckets attached around a shaft, causing the shaft to rotate. This motion in turn is used to drive the rotor of an electric generator. The first such station was built in Wisconsin in 1882.

*Gas turbines* are used to drive electric generators, as in a gas turbine-electric locomotive, and high-speed tools. The term gas turbine is usually applied to a unit whose essential components are a compressor, a combustion chamber, and a turbine that resembles a steam turbine. The turbine drives the compressor, which feeds high-pressure air into the combustion chamber. There it is mixed with a fuel and burned, providing high-pressure gases to drive the turbine.

*A wind turbine* is a device that converts kinetic energy from the wind, also called wind energy, into mechanical energy; a process known as wind power. Wind turbines use an airfoil to generate a reaction lift from the moving fluid and impart it to the rotor. Wind turbines also gain some energy from the impulse of the wind, by deflecting it at an angle.

**Exercise 3. Work in pairs. Answer the following questions:**

- 1 Give the definition to the word *turbine*.
- 2 How can turbines be classified?
- 3 What kinds of turbines have a great importance for generation of electricity?
- 4 How does a turbine look like?
- 5 What does a turbine consist of?
- 6 What are nozzles intended for?

7 What principles are employed by turbines to collect the energy?

8 What does the term *impulse* mean?

9 What is the main difference between a reaction turbine and an impulse turbine?

10 Does a reaction turbine have fixed nozzles?

11 What is a hydraulic turbine?

12 Where are gas turbines used?

13 How does a wind turbine operate?

**Exercise 4. Express the same in English.**

Парова турбіна, виробляти електрику, перетворювати енергію в роботу, розширення пари, зменшення тиску, активна турбіна, збільшення швидкості, повітряний генератор, реактивна турбіна, примусити вал обертатись, приводити робоче колесо до руху, рухомі та нерухомі лопаті, проходить через сопла, камера згоряння, повітря високого тиску, повітряний генератор.

**Exercise 5. Guess and match the definition in the left column with the appropriate term in the right one. Begin your question and answer it as suggested below:**

**What do we call.....?**

We call it.....

a rotating part of a mechanical device	<i>nozzle</i>
portion of a machine with an edge designed to modify parameters of gas or liquid	<i>combustion chamber</i>
the rate of speed of action or occurrence	<i>energy</i>
a device intended for steam to pass through	<i>rotor</i>
the part of an engine in which fuel is burned	<i>pressure</i>
the condition of being pressed	<i>blade</i>
capacity of acting, operating, or producing an effect	<i>velocity</i>



**Exercise 6. Decide whether the sentences are true or false, and correct the false sentences.**

1 Turbines are classified into five groups according to the fuel used: water, steam, wind, gas and wood.

2 Gas turbines are most often used for generation of electricity.

3 The most useful turbines for many purposes are those that can be propelled with energy from water.

4 A reaction turbine rotates its blades which are mounted on the revolving rotor; they are called moving blades.

5 The impulse turbine has a rotor, a shaft, a compressor and nozzles.

6 The first hydraulic turbine was built in Wisconsin in 1882.

7 In gas turbines the blades drive the compressor, which feeds low-pressure air into the combustion chamber.

8 A wind turbine is a device that converts kinetic energy from the wind.

**Exercise 7. Make up the plan and retell the text “Turbines”.**

### UNIT 3

**Exercise 1. Read the following words, word-combinations and their Ukrainian equivalents. Repeat them after the teacher. Try to memorize them.**

**power station** – електростанція (syn. **power plant**), **thermal power station** – теплоелектростанція (ТЕС), **a fossil fuel power plant** – електростанція на органічному паливі, **nuclear power plant** – атомна електростанція (АЕС), **hydroelectric power station** – гідроелектростанція (ГЕС)

**industrial facility** – промисловий об’єкт

**to vary** – змінюватись

**according to** – згідно з

**turbine-generator** – турбогенератор

**to spin** – обертати

**coil of wires** – котушка дротів

**condenser** – конденсатор

**irrespective** – незалежно

**to pollute** – забруднювати  
**fume** – газ, дим  
**conventional** – звичайний  
**to harness** – використовувати (як джерело енергії)  
**nuclear fission** – ядерний поділ  
**to split** – розщеплювати  
**eventually** – у кінцевому підсумку, врешті-решт  
**containment** – захисна оболонка ядерного реактора  
**leakage** – витікання, просочування  
**environment** – навколишнє середовище  
**protective shield** – захисний щит  
**a dome of concrete** – бетонний купол  
**external impact** – зовнішній вплив  
**engineering structure** – інженерні споруди  
**water conduit** – водопровід  
**water intake** – водозабірна споруда  
**pressure head** – напір  
**to couple** – з'єднувати  
**the quantity** – кількість  
**water flow** – потік води  
**diversion** – водовідвід, дериваційна ГЕС  
**pumped-storage power station** – гідроакumuлююча електростанція (ГАЕС)  
**tidal power station** – припливна електростанція (ПЕС)

### **Exercise 2. Translate the following expressions.**

Burning of a fuel, to spin the blades, to turn a coil of wires, pollute the atmosphere, smoke and fumes, to create a pressure head, the quantity of electricity, to be used in the generator, to be defined as fossil fuel power plant, nuclear fission creates radioactivity, to harness the energy, to split atoms, be installed irrespective of, to protect against external impacts, to prevent leakage, to be surrounded by a protective shield, the volume of water flow, to be coupled to hydro turbine.

### **Power Stations**

A power station is an industrial facility that converts some form of mechanical, chemical, or nuclear energy into electrical energy. The

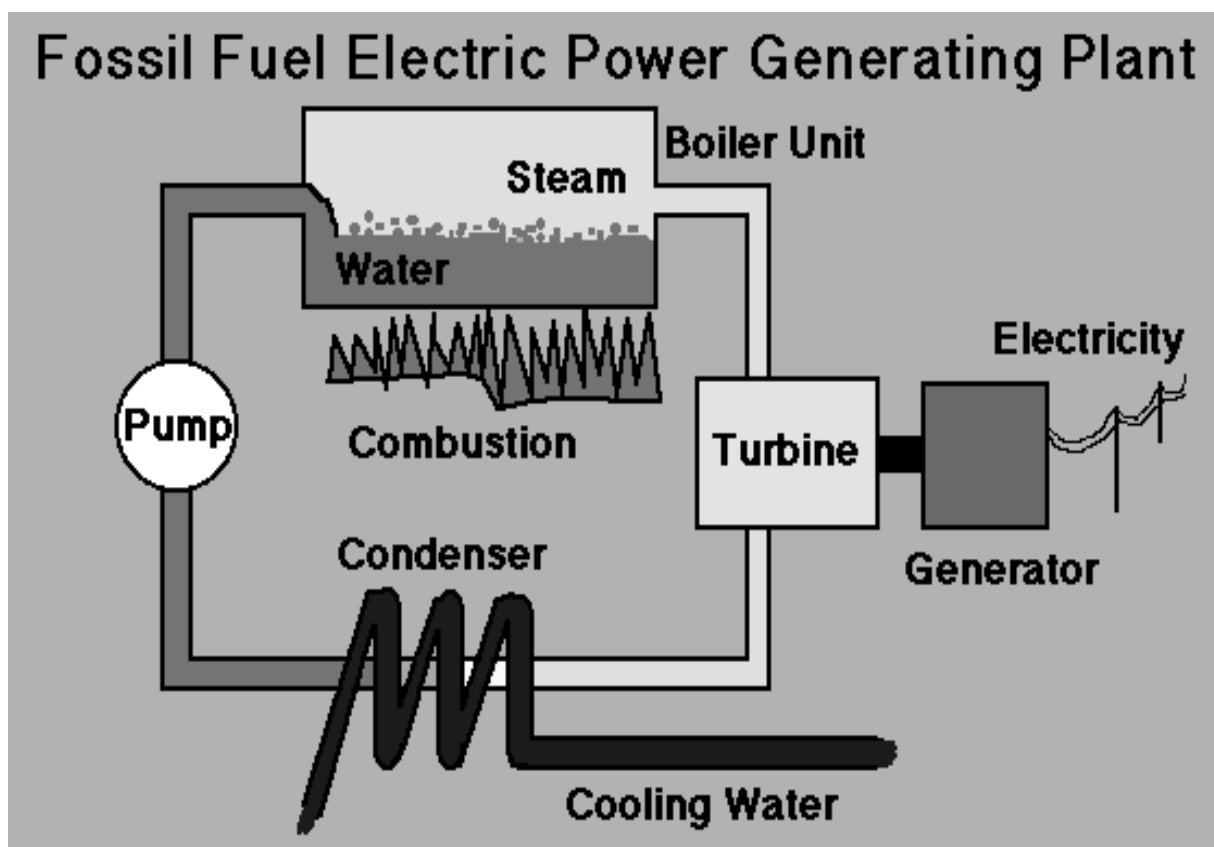
electrical energy generated is commonly called the "power". Mechanical sources of energy at power stations generally include wind and water. Chemical sources almost always involve the burning of a fuel, such as coal, natural gas, and gasoline. Stationary power plants (electric generating stations) are located near sources of stored energy (coal fields, river dams) or are located near the places where the work is to be performed (in cities or industrial sites).

Power plants have a number of components in common:

*Boiler Unit:* Almost all of power plants operate by heating water in a boiler unit into super heated steam at very high pressures. The source of heat from combustion reactions may vary according to the source of fuels.

*Turbine-Generator:* The super heated steam is used to spin the blades of a turbine which in turn is used in the generator to turn a coil of wires. The rotating coil of wires results in the generation of electricity.

*Condenser:* After the steam travels through the turbine, it must be cooled and condensed back into liquid water to start the cycle over again.



*A thermal power station* is a power plant in which the prime mover is steam driven. Water is heated, turns into steam and spins a

steam turbine which drives an electrical generator. After it passes through the turbine, the steam is condensed in a condenser and recycled to where it was heated.

Thermal power stations use quite cheap fuel and they can be installed at any place irrespective of the existence of coal. The coal can be transported to the site of the plant by rail or road. However, they pollute the atmosphere due to production of large amount of smoke and fumes.

According to the type of fuel all thermal power stations are defined as fossil fuel power plants (FFPP) and nuclear power plants (NPP).

*A fossil-fuel power station* is a type of power station that burns fossil fuels such as coal, natural gas or petroleum (oil) to produce electricity. In many countries, such plants provide most of the electrical energy used. Fossil fuel power stations have rotating machinery to convert the heat energy of combustion into mechanical energy, which then operates an electrical generator. All plants use the energy extracted from expanding gas - steam or combustion gases.

FFPP is also known as a steam electric power plant in the US, a thermal power plant in Asia, or a power station in the United Kingdom.

*A nuclear power plant* is a thermal power station which harnesses the energy inside atoms themselves and converts this to electricity. NPP are powered by Uranium.

**Nuclear fission → Heat water to make steam → Steam turns turbines → Turbines turn generators → Electrical power**

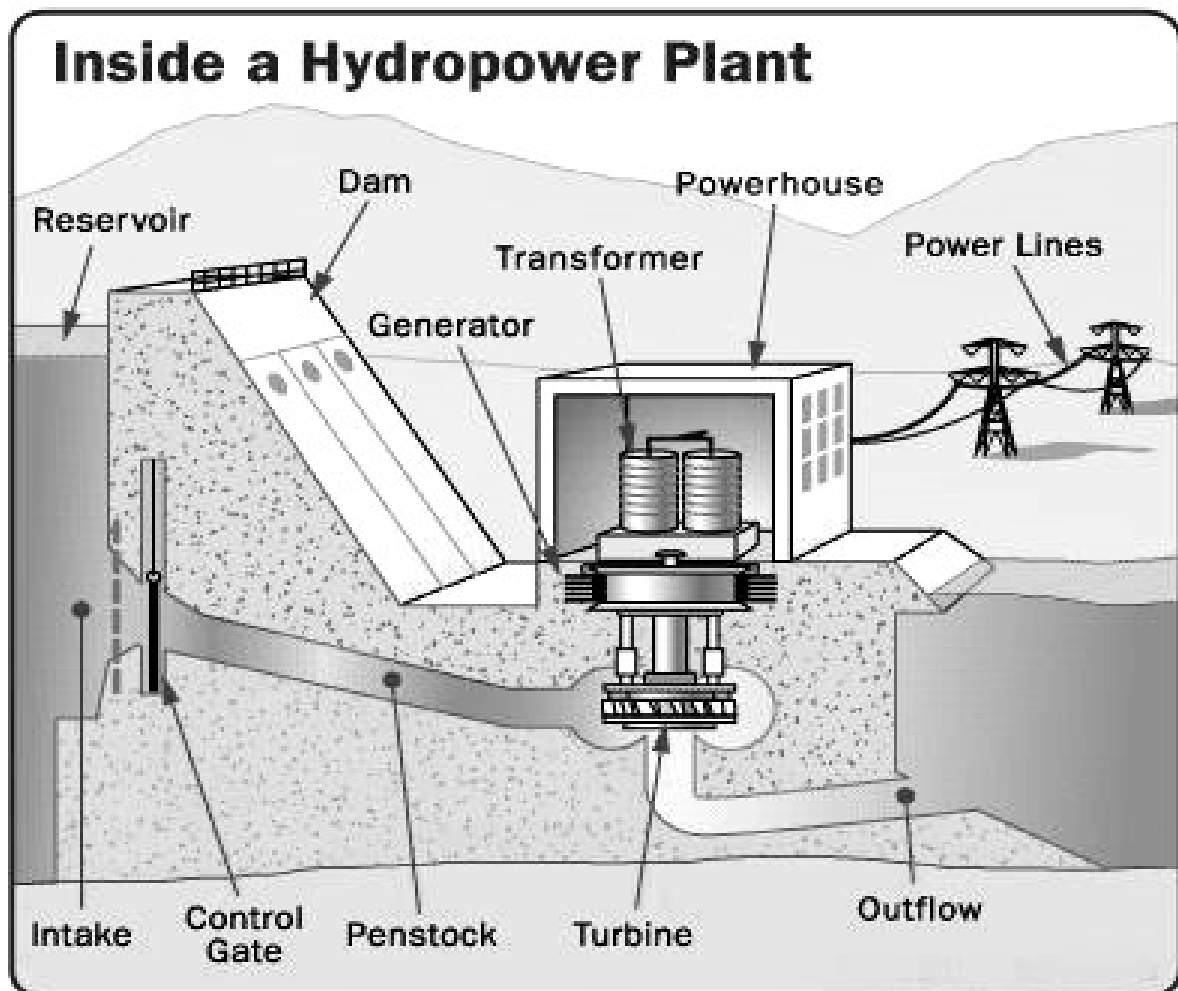
In a process known as nuclear fission, uranium atoms are split to produce large amount of energy which is eventually converted to heat. As in a conventional thermal power station the heat is used to generate steam which drives a steam turbine connected to a generator which produces electricity.

The energy source in atomic power plants is a nuclear reactor. A nuclear reactor maintains and controls the nuclear reaction within the plant to produce energy.

Since nuclear fission creates radioactivity, the reactor core is surrounded by a protective iron or steel shield. This containment absorbs radiation and serves as a barrier to prevent leakage of any

radioactive material from the plant into the environment. In addition, many reactors are equipped with a dome of concrete to protect the reactor against external impacts.

**Hydroelectric power stations** produce electricity by converting the energy of a stream of water. Such plants include hydraulic engineering structures such as a dam, water conduits, and water intake. They provide the necessary concentration of water flow and create a pressure head. The concentrated and directed flow of water rotates the hydro turbine and the hydroelectric generator coupled to it. The quantity of electricity generated is determined by the volume of water flow and the height (called the head) of the dams. Simply, the greater the flow and the taller the head means the more electricity produced. Depending on the design format for using the water resources and concentrating the pressure heads, hydroelectric power plants are usually classified as channel, dam, diversion, pumped-storage and tidal types.



**Exercise 3. Work in pairs. Answer the following questions:**

- 1 Give the definition to the word *power station*.
- 2 Where are stationary power plants located?
- 3 Do power plants have a number of components in common?

What are they?

- 4 What is a thermal power station? Where can it be installed?
- 5 What is a fossil-fuel power station? What kinds of fuel are used in it?
- 6 What is a nuclear power plant?
- 7 Are NPP powered by Uranium?
- 8 What process is known as nuclear fission?
- 9 Is the energy source in atomic power plants a nuclear reactor?
- 10 How does the containment provide the safety for the reactor core?
- 11 What is a hydroelectric power plant?
- 12 What engineering structures provide the necessary concentration of water flow and create a pressure head?
- 13 What is the quantity of electricity generated in hydroelectric power plant determined by?
- 14 How can hydroelectric power plants be classified?

**Exercise 4. Match the pairs of synonyms in the two columns and give their Ukrainian equivalents:**

- |            |             |
|------------|-------------|
| plant      | to spin     |
| energy     | fume        |
| to produce | to classify |
| to rotate  | to connect  |
| component  | to differ   |
| smoke      | structure   |
| to define  | to defend   |
| to couple  | power       |
| to vary    | make        |
| facility   | thanks to   |
| protect    | to generate |
| due to     | outflow     |
| to create  | station     |
| leakage    | unit        |

**Exercise 5. Find appropriate terms from the text to the definitions given below:**

1 An electric power station operating on organic fuel. 2 The energy source in atomic power plant. 3 A component of a power plant in which water is heated and turned into super heated steam. 4 Mechanical sources of energy at power stations. 5 Chemical sources of energy at power plants. 6 Radioactive element used in nuclear power plants. 7 A kind of electric power station that produce electricity by converting the energy of a stream of water. 8 Hydraulic engineering structures. 9 A barrier to prevent leakage of any radioactive material from the plant into the environment. 10 The process of splitting uranium atoms to produce large amount of energy.

**Exercise 6. Express the same in English.**

Розташовуватись біля джерел енергії, спалювання палива, обертання котушки дротів, починати цикл знову, забруднювати атмосферу, відповідно до типу палива, використовувати енергію, гази згоряння, ядерний реактор, завдяки, захисна оболонка ядерного реактора, охолодження води, ядерний поділ, створювати радіоактивність, запобігати витіканню, захищати від зовнішнього впливу, інженерні споруди, створювати напір, необхідна концентрація потоку води, обертати гідротурбіну.

**Exercise 7. Choose one type of power plants and prepare a report about it.**

## UNIT 4

**Exercise 1. Read the following words, word-combinations and their Ukrainian equivalents. Repeat them after the teacher. Try to memorize them.**

**to refer to** – належати до

**energy source** – джерело енергії

**the burning of fossil fuels** – спалювання викопного палива

**splitting of atoms** – розщеплення атомів

**to be renewable** – поновлюватися

**solar energy** – сонячна енергія

**bountiful** – рясний

**to be extracted** – бути витягнутим  
**conversion** – перетворення  
**solar cells** – сонячні батареї  
**device** – пристрій  
**exposed to light** – під впливом світла  
**solar water heating** – системи сонячного нагріву води  
**solar furnace** – сонячна піч  
**to grind grain** – молоти зерно  
**to pump water** – накачувати воду  
**geothermal energy** – геотермальна енергія  
**the earth's core** – ядро землі  
**means of delivering** – засоби доставки  
**biofuel** – біопаливо  
**to be derived from** – одержувати від  
**landfill** – звалище  
**algae** – морські водорості  
**waste energy** – енергія відходів  
**environmentally friendly** – екологічно чисті  
**tidal energy** – енергія припливу  
**electricity generation** – вироблення електроенергії  
**hybrid drive** – гібридний привід  
**conventional diesel drive** – традиційний дизельний привід  
**exhaust emissions** – викид вихлопних газів  
**hydraulic or electric transmission** – гідравлічна або електрична передача

### **Exercise 2. Translate the following expressions.**

Alternative energy refers to, be based on the burning of fossil fuels, renewable energy projects, the most bountiful and cleanest sources of energy, does not need to be extracted, the conversion of sunlight into electricity, devices that create, electricity, be a highly efficient means of delivering, be derived from various energy sources, tidal energy generators, environmentally friendly solution, the purpose of the hybrid drive, minimize exhaust emissions, diesel driven with hydraulic or electric transmission.

### **Alternative Energy Sources**



Alternative energy refers to energy sources which are not based on the burning of fossil fuels or the splitting of atoms. It comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). While many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas, where energy is often crucial in human development. Fortunately there are many means of harnessing energy which have less damaging impacts on our environment.

***Solar energy.*** Solar energy is one of the most bountiful and cleanest sources of energy on our planet. Solar energy does not need to be extracted, transported to and from, nor is any costly exploration required to find it. Solar power is the conversion of sunlight into electricity. There are three main ways that we use the Sun's energy:

*Solar cells* (photovoltaic solar panels) are devices that create electricity by converting sunlight into energy. You may have noticed that certain small devices like a solar-powered calculator won't work in the dark, but when exposed to light it will work just fine. *Solar water heating* is a process when heat from the Sun is used to heat water in glass panels on your roof. This means you don't need to use so much gas or electricity to heat your water at home. *A solar furnace* is a structure that uses concentrated solar power to produce high temperatures, usually for industry. Parabolic mirrors or heliostats concentrate the Sun's energy into a small space and produce very high temperatures. This heat can be used to generate electricity, melt steel, make hydrogen fuel or nanomaterial.

***Wind power.*** The terms *wind energy* or *wind power* describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity. The best places for wind farms are in coastal areas, at the tops of rounded hills, open plains and gaps in mountains - places where the wind is strong and reliable.

***Geothermal.*** Geothermal energy is a kind of power that makes use of the earth's heat. In some areas of the world geothermal energy has been used for thousands of years. The earth's core is very hot. It

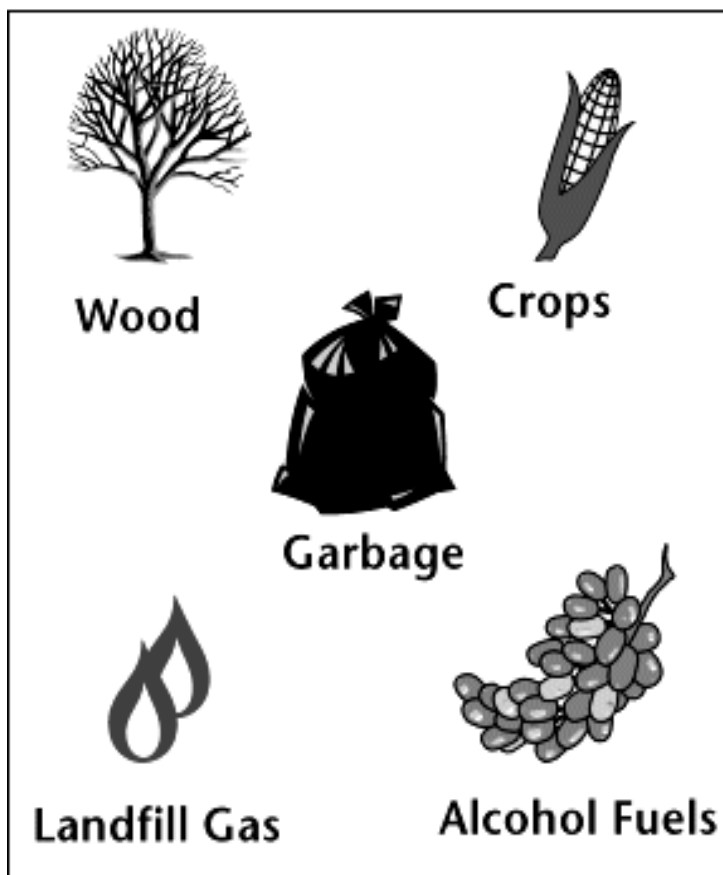
has a temperature so hot that it can melt rock. In areas with lots of volcanoes molten rock can be found very close to the surface.

The production of electricity from geothermal energy sources can be a highly efficient means of delivering clean and renewable electricity to many people.

**Tidal energy.** Tidal energy is produced through the use of tidal energy generators. Tidal power has great potential for future power and electricity generation because of the massive size of the oceans. This tidal electricity generation works as the tide come in and again when it goes out. The turbines are driven by the power of the sea in both directions.

**Biomass and biofuel.** Biomass is organic material made from plants and animals. Biomass energy is derived from various energy sources among them wood, waste, crops, manure, algae, etc. The most

## Types of Biomass



common form of biomass is wood. For thousands of years people have burned wood for heating and cooking. Nowadays many manufacturing plants in the wood and paper products industry use wood waste to produce their own steam and electricity. Another source of biomass energy is our garbage. It can be a source of energy by burning in waste-to-energy plants, or by capturing biogas. In landfills, biomass rots and releases methane gas, also called biogas or landfill gas. Some landfills have a

system that collects the methane gas so that it can be used as a fuel source. *Biofuels* (ethanol, biodiesel and biogas) are fuels from biomass materials. Algae have great potential in this respect. They are easy to grow; they can grow anywhere and are environmentally friendly. The

green waste left over from the algae oil extraction can be used to produce butanol. Crops like corn and sugar cane can be fermented to produce the transportation fuel, ethanol. Biodiesel can be produced from left-over food products like vegetable oils and animal fats.

***Alternative energy sources for rail transport.*** Speaking of the alternative energy, one should mention about using it in the railway. Hybrid drive is more environmentally friendly solution to conventional diesel drive. The purpose of the hybrid drive is to save energy and minimize exhaust emissions compared to diesel driven with hydraulic or electric transmission. Thus, a locomotive with a hybrid drive is a competitive product due to the economic benefits for consumers (fuel economy), the benefits for the environment (reduction of emissions in accordance with local requirements or even more), and flexibility in using in a variety of shunting operations.

**Exercise 3. Work in pairs. Answer the following questions:**

- 1 How does alternative energy differ from conventional energy?
- 2 Where does alternative energy come from?
- 3 What areas are renewable technologies suited to?
- 4 What examples of alternative energy can you name?
- 5 What is solar energy and where can we use it?
- 6 What is wind energy and where are the best places for wind farms?
- 7 What is geothermal energy?
- 8 Why has tidal power great potential for future?
- 9 What is biomass and where is biomass energy derived from?
- 10 What is waste energy?
- 11 Why do algae have a great potential for biofuel?
- 12 What alternative energy is being created in the railway transport?
- 13 What is the purpose of the hybrid drive?
- 14 Why is a locomotive with a hybrid drive a competitive product?
- 15 Why alternative energy is so important nowadays?

**Exercise 4. Choose the right variant.**

- 1 Alternative energy is based on ...
  - a) the burning of fossil fuels or the splitting of atoms.
  - b) converting nuclear energy into electrical energy.
  - c) the electrical generator.

d) the chemical sources.

**2** Solar energy does not need to be ...

- a) be extracted.
- b) be transported to and from.
- c) be found.
- d) all from above mentioned.

**3** Solar panels create electricity by ...

- a) converting mechanical power.
- b) converting sunlight into energy.
- c) converting wind power.
- d) converting water power.

**4** Geothermal energy is ...

- a) a kind of power that makes use of the earth's heat.
- b) a kind of power that makes use of biofuel.
- c) a kind of power that makes use of tidal energy.
- d) a kind of power that makes use of steam.

**5** Biomass is considered:

- a) only wood.
- b) oil from deep beneath the earth's surface.
- c) organic material from plants or animals.
- d) only waste.

**6** Which of the following statements is **not** correct?

- a) Burning biomass fuels does not produce pollutants like sulfur that can cause acid rain.
- b) Biomass does not pollute the air.
- c) Biofuel is much more polluting than petroleum diesel.
- d) Solid wastes can be burned to provide heat.

**7** Alternative energy source for rail transport is ...

- a) conventional diesel drive.
- b) electric transmission.
- c) hydraulic transmission.
- d) hybrid drive.

**Exercise 5.** Complete the following sentences using suitable words or phrases from the box below:

*won't work, algae, rural and remote areas, burning of fossil fuels, a hybrid drive, convert, solar power, lots of volcanoes, splitting of atoms.*

- 1 Alternative energy refers to energy sources which are not based on the ..... or the .....
- 2 Energy is often crucial in human development in .....
- 3 ..... is the conversion of sunlight into electricity.
- 4 A solar-powered calculator ..... in the dark.
- 5 Wind turbines ..... the kinetic energy in the wind into mechanical power.
- 6 Geothermal energy has been used in areas with .....
- 7 ..... can grow anywhere and are environmentally friendly.
- 8 A locomotive with ..... is a competitive product.

**Exercise 6. Express the same in English.**

Альтернативні джерела енергії, сільські та віддалені території, шкідливий вплив на навколишнє середовище, перетворення енергії в електрику, плавити сталь, виробляти механічну енергію, використовувати для особливих завдань, сильний та надійний, бути розташованим близько до поверхні, використовувати відходи, щоб отримати пар, в цьому відношенні, мати великий потенціал для майбутнього, в обох напрямках, зберегти енергію, знизити викиди, порівняно з, економічні вигоди для споживачів, згідно з потребами.

**Exercise 7. Choose one of the alternative energy sources and make a presentation on it.**