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PROFESSIONAL ORIENTED FOREIGN LANGUAGE

Study guide for students of speciality 5B071700 – Heat power engineering for improvement on students' reading skills of scientific and technical texts

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This study guide is intended for intermediate students of English of the specialty 5B071700 "Heat power engineering" for improvement on students' reading skills of scientific and technical texts.

The study guide deals with the basics of translation, lexical difficulties of translation of scientific and technical literature. Much attention is paid to the terminology, which makes it possible to increase the active vocabulary by specialty. It might be used in class with a teacher as well as a self-study book.

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Introduction

This study guide is intended for intermediate students of English of the specialty 5B071700 “Heat power engineering”. It might be used in class with a teacher as well as a self-study book.

There are two parts in this study guide. Each part looks at a particular area of heat power engineering. The first part introduces a classical description of all the most important aspects of heat power engineering. The second part is rather peculiar as it introduces a very popular theme nowadays i.e. new ways to get energy, and some of the ideas will surprise you. Get ready for the children whose running feet make the energy to bring water to their village; for the power station that uses warm and cold water to make energy; for the car that saves energy by growing like a plant or a car that sails with the wind, a turbine at the bottom of a river, machines that use the heat from people’s bodies- these are some of the places that the energy of the future will come from. And that future is not far away…

It is not necessary to read all the texts in order. If you know what aspects you have difficulty with, go straight to the texts that deal with them, using the Contents to help you find the relevant text.

You can use the texts in a number of ways. You can just read the text and translate it with a vocabulary below. On the other hand, if the text is not difficult for you it is not necessary to search for the words in vocabulary but to do the exercises instead, for better understanding of the text.

We hope that this study guide will help you to improve your English and broaden the number of terms for your future specialty.

Part 1

Read and translate the text.

Furnaces in general

Furnace - a container that is heated to a very high temperature, so that substances that are put inside it, such as metal, will melt or burn. A furnace is a device used for high-temperature heating. The name derives from Greek word «fornax», which means oven. The heat energy to fuel a furnace may be supplied directly by fuel combustion, by electricity such as the electric arc furnace, or through induction heating in induction furnaces.

In American English and Canadian English usage, the term furnace refers to the household heating systems based upon a central furnace, otherwise known either as a boiler, or a heater in British English. Furnace may also be a synonym for kiln, a device used in the production of ceramics.

In British English, a furnace is an industrial furnace used for many things, such as the extraction of metal from ore (smelting) or in oil refineries and other chemical plants, for example as the heat source for fractional distillation columns. The term furnace can also refer to a direct fired heater, used in boiler applications in chemical industries or for providing heat to chemical reactions for such processes as cracking, and is part of the standard English names for many metallurgical furnaces worldwide.

Furnaces can be classified into four general categories, based on efficiency and design.

Vocabulary.

Crack-to break something so that it does not separate, but very thin lines appear on its surface, or to become broken in this way (расколоть).

Combustion-the process of burning; the chemical process in which substances mix with oxygen in the air to produce heat and light (воспламенение, сгорание).

Efficiency-when someone or something uses time and energy well, without wasting any (эффективность, производительность).

Fractional distillation-(chemistry) separation of a liquid mixture into fractions differing in boiling point (and hence chemical composition) by means of distillation, typically using a fractionating column.

Fractionating column-(chemistry) a tall, horizontally subdivided container for fractional distillation in which vapor passes upwards and condensing liquid flows downwards. The vapor becomes progressively enriched in more volatile components as it ascends, and the less volatile components become concentrated in the descending liquid, which can be drawn off.

Furnace-a container that is heated to a very high temperature, so that substances that are put inside it, such as metal, will melt or burn (очаг, печь, топка).

Kiln-a furnace or oven for burning, baking, or drying, especially one for calcining lime or firing pottery (печь).

Oven- the part of a cooker with a door, which is used to cook food (духовка, печь).

Refinery- a factory where raw substances such as oil or sugar are made pure (нефтеочистительный завод).

Smelt- to get a metal from rock by heating it to a very high temperature, or to melt objects made from metal in order to use the metal to make something new (выплавлять, выплавить).

Exercise 1. Answer the questions.

1. Give the meaning of a word «furnace».
2. What is a furnace used for?
3. Give the origin of a word «furnace».
4. Name the synonyms of a word «furnace».
5. Explain the meaning of a word «furnace» in industry.

Exercise 2. Decide if the following statements are true or false.

1. Furnace is a container that is heated to a very high temperature. T/F.
2. Furnace is a device used for high-temperature heating. T/F.
3. The name «furnace» derives from Greek word «fornax». T/F.
4. Furnace may also be a synonym for kiln. T/F.
5. Furnace is an industrial furnace used for many things. T/F.
6. The term furnace can also refer to a direct fired heater. T/F.
7. Furnaces can be classified into two general categories. T/F.

Exercise 3. Find the synonyms in the following list of words.

Furnace, origin, oven, derivation, oil, upwards, worldwide, fuel, high, application, boiler, usage, heater, everywhere.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. People who work with furnaces need to wear protective clothes.
2. Place the cake in the oven at 200 C^0.
3. Calcutta in summer is like an oven (extremely and uncomfortably hot).
4. Cook the meat on a high/low heat (=high/low temperature).
5. Could you boil the kettle for me?

Read and translate the text.

Types of furnaces

Let us observe the diagram of natural draft gas furnace of the early 20th century. The first category would be natural draft, atmospheric burner furnaces. These furnaces consisted of cast-iron or riveted-steel heat exchangers built within an outer shell of brick, masonry, or steel. The heat exchangers were vented through

brick or masonry chimneys. Air circulation depended on large, upwardly pitched pipes constructed of wood or metal. The pipes would channel the warm air into floor or wall vents inside the home. This method of heating worked because warm air rises. The system was simple, had few controls, a single automatic gas valve, and no blower. These furnaces could be made to work with any fuel simply by adapting the burner area. They have been operated with wood, coke, coal, trash, paper, natural gas, and fuel oil. Furnaces that used solid fuels required daily maintenance to remove ash and "clinkers" that accumulated in the bottom of the burner area. In later years, these furnaces were adapted with electric blowers to aid air distribution and speed moving heat into the home. Gas and oil-fired systems were usually controlled by a thermostat inside the home, while most wood and coal-fired furnaces had no electrical connection and were controlled by the amount of fuel in the burner and position of the fresh-air damper on the burner access door.

The second category of furnace is the forced-air, atmospheric burner style with a cast-iron or sectional steel heat exchanger. Through the 1950s and 1960s, this style of furnace was used to replace the big, natural draft systems, and was sometimes installed on the existing gravity duct work. The heated air was moved by blowers which were belt driven and designed for a wide range of speeds. These furnaces were still big and bulky compared to modern furnaces, and had heavy-steel exteriors with bolt-on removable panels. Energy efficiency would range anywhere from just over 50% to upward of 65% AFUE. This style furnace still used large, masonry or brick chimneys for flues and was eventually designed to accommodate air-conditioning systems.

The third category of furnace is the forced draft, mid-efficiency furnace with a steel heat exchanger and multi-speed blower. These furnaces were physically much more compact than the previous styles. They were equipped with combustion air blowers that would pull air through the heat exchanger which greatly increased fuel efficiency while allowing the heat exchangers to become smaller. These furnaces may have multi-speed blowers and were designed to work with central air-conditioning systems.

The fourth category of furnace is the high-efficiency, or condensing furnace. High-efficiency furnaces can achieve from 89% to 98% fuel efficiency. This style of furnace includes a sealed combustion area, combustion draft inducer and a secondary heat exchanger. Because the heat exchanger removes most of the heat from the exhaust gas, it actually condenses water vapor and other chemicals (which form a mild acid) as it operates. The vent pipes are normally installed with PVC pipe versus metal vent pipe to prevent corrosion. The draft inducer allows for the exhaust piping to be routed vertically or horizontally as it exits the structure. The most efficient arrangement for high-efficiency furnaces include PVC piping that brings fresh combustion air from the outside of the home directly to the furnace. Normally the combustion air (fresh air) PVC is routed alongside the exhaust PVC during installation and the pipes exit through a sidewall of the home in the same location. High efficiency furnaces typically deliver a 25% to 35% fuel savings over a 60% AFUE furnace.

Vocabulary.

Air-conditioning- the system used for keeping the air in a building or vehicle cool (кондиционирование воздуха).

Blower- a person or thing that blows, especially a mechanical device for creating a current of air used to dry or heat something.

Bulky- too big and taking up too much space (объемистый, громоздкий).

Cast-iron - very strong (чугунный, стальной, железный, несгибаемый).

Condense - to make a liquid thicker by removing some of the water; to change or make something change from a gas to a liquid or solid state (конденсировать, сгущать).

Corrosion- the process of corroding or being corroded; damage caused by such a process (коррозия, ржавчина).

Clinker- the ash (=powder) and rough hard pieces that remain after coal has been burned (клинкер, шлак).

Damper- a movable metal plate in a flue or chimney, used to regulate the draught and so control the rate of combustion (заслонка, амортизатор, глушитель).

Exhaust- the waste gas from an engine, especially a car's, or the pipe the gas flows through (выхлоп, выпуск и отработанный газ).

PVC- polyvinyl chloride- a tough chemically resistant synthetic resin made by polymerizing vinyl chloride and used for a wide variety of products including pipes, flooring, and sheeting.

Rivet- a short metal pin or bolt holding together two plates of metal, its headless end being beaten out or pressed down when in place (заклепка).

Thermostat- a device which keeps a building, engine, etc. within a usually limited temperature range by automatically switching the supply of heat on and off (термостат).

To vent- provide with an outlet for air, gas, or liquid (изливать, давать выход).

Upwardly- in an upward direction (towards a higher place, point, or level) (направленный вверх).

Exercise 1. Answer the questions.

1. Can you describe the structure of atmospheric burner furnaces?
2. Could these furnaces be made to work with any fuel?
3. Name all the types of fuel that can be used.
4. What is special about furnaces where solid fuels are used?
5. How gas and oil-fired systems were usually controlled?
6. What is the name of the second category of furnace?
7. Explain the way how such furnaces work.
8. Do people still use such types of furnaces?
9. What are the advantages of the third category of furnace?
10. What is the most efficient arrangement for high-efficiency furnaces?

Exercise 2. Find the nouns among this list of words.

Furnace, burner, brick, masonry, exchanger, heat, combustion, condensing, range, vapor, prevent, horizontally, efficiency, smaller, exhaust, installation, installed, sidewall, alongside, wood, removable, arrangement.

Exercise 3. Decide if the following statements are true or false.

1. Atmospheric burner furnaces are the first category of furnaces. T/F.
2. These furnaces consisted of cast-iron heat exchangers. T/F.
3. The heat exchangers were vented through masonry chimneys. T/F.
4. The first category furnaces have been operated only with wood. T/F.
5. The second category furnaces were still big and bulky. T/F.
6. The third category furnaces were physically much more compact. T/F.
7. The fourth category furnace is the high-efficiency furnace. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. It's cold in here- should I turn on the furnace?
2. This room's like a furnace (=it's very hot)!
3. Factory chimneys belched dense white smoke into the sky.
4. If there's a gas fire in a room, there must be some kind of outside vent.
5. Can you give me a cast-iron guarantee, that the work will be done?
6. Water vapor in the air condenses into fog.
7. There was a lot of corrosion on the bottom of the car.
8. Car exhaust is the main reason for the city's pollution.

Read and translate the text.

Turbines

A turbine is a machine that transforms rotational energy from a fluid that is picked up by a rotor system into usable work or energy. A turbine (from the Latin turbo, a vortex, related to the Greek τύρβη, tyrbē, meaning "turbulence") is a rotary mechanical device that extracts energy from a fluid flow and converts it into useful work. The work produced by a turbine can be used for generating electrical power when combined with a generator or producing thrust, as in the case of jet engines. A turbine is a turbo machine with at least one moving part called a rotor assembly, which is a shaft or drum with blades attached. Moving fluid acts on the blades so that they move and impart rotational energy to the rotor. Early turbine examples are windmills and waterwheels.

Gas, steam, and water turbines have a casing around the blades that contains and controls the working fluid. Credit for invention of the steam turbine is given both to British engineer Sir Charles Parsons (1854–1931) for invention of the reaction turbine, and to Swedish engineer Gustaf de Laval (1845–1913) for invention of the impulse turbine. Modern steam turbines frequently employ both

reaction and impulse in the same unit, typically varying the degree of reaction and impulse from the blade root to its periphery.

The word "turbine" was coined in 1822 by the French mining engineer Claude Burdin from the Latin turbo, or vortex, in a memo, "Des turbines hydrauliques ou machines rotatoires à grande vitesse", which he submitted to the Académie royale des sciences in Paris. Benoit Fourneyron, a former student of Claude Burdin, built the first practical water turbine. Almost all electrical power on Earth is generated with a turbine of some type. Very high efficiency steam turbines harness around 40% of the thermal energy, with the rest exhausted as waste heat. Most jet engines rely on turbines to supply mechanical work from their working fluid and fuel as do all nuclear ships and power plants.

Turbines are often part of a larger machine. A gas turbine, for example, may refer to an internal combustion machine that contains a turbine, ducts, compressor, combustor, heat-exchanger, fan and (in the case of one designed to produce electricity) an alternator. Combustion turbines and steam turbines may be connected to machinery such as pumps and compressors, or may be used for propulsion of ships, usually through an intermediate gearbox to reduce rotary speed.

Reciprocating piston engines such as aircraft engines can use a turbine powered by their exhaust to drive an intake-air compressor, a configuration known as a turbocharger (turbine supercharger) or, colloquially, a "turbo".

Turbines can have very high power density (i.e. the ratio of power to weight, or power to volume). This is because of their ability to operate at very high speeds. The Space Shuttle main engines used turbo pumps (machines consisting of a pump driven by a turbine engine) to feed the propellants (liquid oxygen and liquid hydrogen) into the engine's combustion chamber. The liquid hydrogen turbo pump is slightly larger than an automobile engine (weighing approximately 700 lb) and produces nearly 70,000 hp (52.2 MW).

Vocabulary.

Combustion- the chemical process in which substances mix with oxygen in the air to produce heat and light (воспламенение, сгорание).

Combustion chamber- a closed space in which combustion happens.

Compressor - a (part of a) machine which presses gas or air into less space (компрессор).

Duct - a tube or pipe that carries liquid or air, especially in and out of buildings or through the body (канал, проток).

Flow - (especially of liquids, gases or electricity) to move in one direction, especially continuously and easily (литься, течь).

Fluid - a substance which flows and is not solid (жидкость, жидкий, текучий).

Harness- to control something, usually in order to use its power (обуздывать, мобилизовать).

Hydrogen - the lightest gas with no color, taste or smell that combines with oxygen to form water (водород).

Jet engine - a very powerful engine. When fuel is burned inside the engine, hot air and gases are produced and then pushed out of the back of the engine at high speed and, this forces the engine forward.

Jet propulsion - powerful forward movement produced by forcing gases backwards, as in a JET ENGINE (реактивное движение).

Oxygen - a colorless gas that forms a large part of the air on Earth and which is needed by people, animals and plants to live (кислород).

Periphery - the outer edge of an area (граница, черта, периферия).

Propulsion - a force that pushes something forward (движение вперед).

Reciprocating engine - an engine in which one or more pistons move up and down in cylinders; a piston engine.

Rotor - a part of a machine that spins, especially the device supporting the spinning blades of a HELICOPTER (ротор, несущий винт).

Rotary - (of a machine) having a part that moves around in a circle (вращающийся).

Shaft - a rod which forms part of a machine such as an engine, and which turns in order to pass power on to the machine (стержень, труба, ручка, рукоятка).

Thrust - the driving force produced by, for example, an aircraft engine (толчок, удар).

Turbo - turbocharger- a small TURBINE turned by the waste gases from an engine which pushes the fuel and air mixture into the engine at a higher pressure, so increasing the power produced by the engine.

Turbine - a type of machine through which liquid or gas flows and turns a special wheel with blades in order to produce power (турбина).

Exercise 1. Answer the questions.

1. What is a turbine?
2. What does this term mean in Greek?
3. How do people use the work produced by a turbine?
4. What are the early turbine examples?
5. Who were the first inventors of the steam turbine?
6. What types of turbines can you name?
7. What is another term of turbocharger (turbine supercharger)?
8. Why can turbines have very high power density?

Exercise 2. Find the adjectives among the following list of words.

Rotational, fluid, usable, rotary, useful, early, gas, steam, water, heat, power, internal, alternator, combustion, propulsion, intermediate, configuration, automobile, propellants.

Exercise 3. Decide if the following statements are true or false.

1. A turbine is a machine that transforms rotational energy. T/F.
2. A turbine is used for generating electrical power. T/F.
3. A turbine is a turbo machine with at least one moving part. T/F.

4. Early turbine examples are windmills and waterwheels. T/F.
5. Gas, steam, and water turbines have a casing around the blades. T/F.
6. Turbines are often part of a larger machine. T/F.
7. Combustion turbines and steam turbines are connected to machinery. T/F.
8. Turbines can have very high power density. T/F.
9. The Space Shuttle main engines can use turbo pumps. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Wood and coal are both combustible substances.
2. Lava from the volcano was flowing down the hillside.
3. People harness wind and waves as new sources of power.
4. The Earth completes 366 rotations about its axis in every leap year.
5. The wind farm is able to generate enough electricity for 2000 homes.
6. Oxygen, hydrogen and nitrogen are all gases.
7. The pump is driven by steam.
8. Scientists are working to harness the power of the atom.
9. Wood, coal, oil, petrol and gas are all different kinds of fuel.

Read and translate the text.

Compressor

Compressor - an electronic device for reducing the variation in signal amplitude in a transmission system.

A gas compressor is a mechanical device that increases the pressure of a gas by reducing its volume. An air compressor is a specific type of gas compressor.
Compressors are similar to pumps: both increase the pressure on a fluid and both can transport the fluid through a pipe. As gases are compressible the compressor also reduces the volume of a gas. Liquids are relatively incompressible; while some can be compressed, the main action of a pump is to pressurize and transport liquids.
An air compressor is a device that converts power (using an electric motor, diesel or gasoline engine, etc.) into potential energy stored in pressurized air (i.e., compressed air). By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure. When tank pressure reaches its upper limit the air compressor shuts off. The compressed air, then, is held in the tank until called into use. The energy contained in the compressed air can be used for a variety of applications, utilizing the kinetic energy of the air as it is released and the tank depressurizes. When tank pressure reaches its lower limit, the air compressor turns on again and re-pressurizes the tank.

Dynamic range compression (DRC) or simply compression is a signal processing operation that reduces the volume of loud sounds or amplifies quiet sounds by narrowing or compressing an audio signal's dynamic range.

Compression is commonly used in sound recording and reproduction, broadcasting, live sound reinforcement and in some instrument amplifiers. A dedicated electronic hardware unit or audio software that applies compression is called a compressor. In the 2000s, compressors became available as software plugins that run in digital audio workstation software. In recorded and live music, compression parameters may be adjusted to change the way they affect sounds. Compression and limiting are identical in process but different in degree and perceived effect. A limiter is a compressor with a high ratio and, generally, a fast attack time.

Vocabulary.

Affect - to have an influence on someone or something, or to cause them to change (действовать, влиять).

Amplitude - a large amount or wide range; the distance between the top and the base of a curve (широта, размах, амплитуда).

Plug-in - a small computer program that makes a larger one work faster or have more features (вставной).

Pressure - the force that a liquid or gas produces when it presses against an area (давление).

Pump - a piece of equipment which is used to cause liquid, air or gas to move from one place to another; to force liquid or gas to move somewhere (насос, выкачивать, накачивать).

Range - the distance that a vehicle or aircraft can travel without having to stop for more fuel (дальность, радиус, расстояние, диапазон).

Ratio - the relationship between two groups or amounts which expresses how much bigger one is than the other (отношение, соотношение).

Shut off - if a machine or system shuts off, it stops operating, and if someone or something shuts it off, they stop it from operating (отключить, выключить).

Volume - the amount of space that is contained within an object or solid shape; the number or amount of something in general (объем).

Exercise 1. Answer the questions.

1. What is a compressor?
2. What is a gas compressor?
3. What is an air compressor?
4. Are compressors similar to pumps?
5. What is DRC?
6. Where can be compression commonly used?
7. When did compressors become available as software plug-ins?
8. How do people use compression in recorded and live music?
9. What can you say about compression and limiting are they similar?

Exercise 2. Find the verbs among the following list of words and give their translation.

Reduce, increase, pressure, convert, store, reach, contain, release, volume, amplify, narrow, compress, reinforce, reproduce, apply, adjust, affect, hardware, software.

Exercise 3. Decide if the following statements are true or false.

1. A compressor is an electronic device. T/F.
2. A gas compressor is a mechanical device. T/F.
3. An air compressor is a specific type of gas compressor. T/F.
4. Compressors are similar to pumps. T/F.
5. The compressor is able to reduce the volume of a gas. T/F.
6. Compression is commences only used in sound recording. T/F.
7. Compression and limiting are identical in process. T/F.

*Exercise 4***.** Translate the following sentences using the key vocabulary above.

1. I was deeply affected by the film (=It caused strong feelings in me).
2. The material allows making gas pipes which withstand high pressures.
3. Our latest machine can pump a hundred gallons a minute.
4. We could see a low range of hills in the distance.
5. The ship was out of range of our guns.
6. The engine shuts off automatically when the desired speed is reached.
7. It's the sheer volume of traffic in the city that is causing the problems.

Read and translate the text.

Industrial fans

Industrial fans are machines whose primary function is to provide and accommodate a large flow of air or gas to various processes of many industries.
Industrial fans and blowers are machines whose primary function is to provide and accommodate a large flow of air or gas to various processes of many industries. This is achieved by rotating a number of blades, connected to a hub and shaft, and driven by a motor or turbine. The flow rates of these mechanical fans range, from approximately 200 cubic feet (5.7 m3) to 2,000,000 cubic feet (57,000 m^3) per minute. A blower is another name for a fan that operates where the resistance to the flow is primarily on the downstream side of the fan.

There are many uses for the continuous flow of air or gas that industrial fans generate, including combustion, ventilation, aeration, particulate transport, exhaust, cooling, air-cleaning, and drying, to name a few. The industries served include electrical power production, pollution control, metal manufacturing and processing, cement production, mining, petrochemical, food processing, cryogenics, and clean rooms.

Centrifugal fans and axial fans, what are they? Most industrial fans may be categorized into one of two general types: centrifugal fans and axial fans.

Centrifugal fans: the centrifugal design uses the centrifugal force generated by a rotating disk, with blades mounted at right angles to the disk, to impart movement to the air or gas and increase its pressure. The assembly of the hub, disk and blades is known as the fan wheel, and often includes other components with aerodynamic or structural functions. The centrifugal fan wheel is typically contained within scroll-shaped fan housing, resembling the shell of the nautilus sea creature with a central hole. The air or gas inside the spinning fan is thrown off the outside of the wheel, to an outlet at the housing's largest diameter. This simultaneously draws more air or gas into the wheel through the central hole. Inlet and outlet ducting are often attached to the fan's housing, to supply and/or exhaust the air or gas to the industry's requirements.

There are many varieties of centrifugal fans, which may have fan wheels that range from less than a foot (0.3 meters) to over 16 feet (5 m) in diameter.

Axial fans: the axial design uses axial forces to achieve the movement of the air or gas, spinning a central hub with blades extending radially from its outer diameter. The fluid is moved parallel to the fan wheel's shaft, or axis of rotation. The axial fan wheel is often contained within a short section of cylindrical ductwork, to which inlet and outlet ducting can be connected.

Axial fan types have fan wheels with diameters that usually range from less than a foot (0.3 meters) to over 30 feet (9 m), although axial cooling tower fan wheels may exceed 82 feet (25 m) in diameter.

In general, axial fans are used where the principal requirement is for a large volume of flow, and the centrifugal design where both flow and higher pressures are required.

Vocabulary.

Aerate - to add a gas to liquid, especially a drink; to allow air to act on something (проветривать).

Blade - a wide flat part on a tool or machine, used to push back water or air (лопасть, лопатка).

Blower - a person or thing that blows, especially a mechanical device for creating a current of air used to dry or heat something.

Centrifugal - (of a turning object) moving away from the point around which it is turning (центробежный).

Cryogenics - the branch of physics dealing with the production and effects of very low temperatures.

Downstream - in the direction a river or stream is flowing (вниз по течению).

Duct - a tube or passageway in a building or machine for air, liquid, cables, etc.; (in a plant) a vessel for conveying water, sap, or air (канал, проток).

Impart - make (information) known; bestow (a quality) (передавать, сообщать).

Industrial fan - промышленный вентилятор

Nautilus - the first nuclear-powered submarine, launched in 1954. This US navy vessel made a historic journey (1-5 August 1958) under the ice of the North Pole.

Outlet - (electrical outlet) a device to which a piece of electrical equipment can be connected in order to provide it with electricity (штепсельная розетка).

Scroll - cause to move like paper rolling or unrolling (прокручивать).

Shaft - a rod which forms part of a machine such as an engine, and which turns in order to pass power on to the machine (вал, ось).

Wheel - a circular object connected at the centre to a bar, which is used for making vehicles or parts of machines move (колесо).

Exercise 1. Answer the questions.

1. What is an industrial fan?
2. What are primary functions of industrial fans?
3. How can these primary functions be achieved?
4. What are the uses for the flow of air or gas that industrial fans generate?
5. Centrifugal fans and axial fans, what are they?
6. What is the difference of usage of centrifugal and axial fans?

Exercise 2. Find the nouns in the following list of words.

Function, accommodate, provide, flow, resistance, downstream, combustion, exhaust, impart, resemble, wheel, attach, outlet, force, pressure, spinning.

Exercise 3. Decide if the following statements are true or false.

1. Industrial fans and blowers are machines. T/F.
2. The blades are connected to a shaft, and driven by a motor or turbine. T/F.
3. A blower is another name for a fan. T/F.
4. The flow of air of the industrial fan produces only combustion. T/F.
5. Most industrial fans may be categorized into two general types. T/F.
6. The centrifugal wheel is contained within scroll-shaped fan housing. T/F.
7. The axial design uses axial forces to achieve the movement of the air. T/F.
8. Axial cooling tower fan wheels exceed 82 feet (25 m) in diameter. T/F.

Exercise 4. Translate the following sentences using the key vocabulary of the text.

1. Earthworms help to aerate the soil.
2. Lava from the volcano was flowing down the hillside.
3. The computer department is at the hub of the company’s operation.
4. The City of London is the hub of Britain’s financial world.
5. There was no air conditioning, just a ceiling fan turning slowly.
6. The current carried her downstream.
7. How long will it be before the world’s fuel supplies are exhausted?
8. Car exhaust is the main reason for the city’s pollution.
9. Her work provided no outlet for her energies and talents.

Read and translate the text.

Application of fans in industry

There are several paths to determining a fan design for an application. For industries where the application requirements do not vary greatly and applicable fan designs have diameters of around 4 feet (1.2 meters) or less, a standard or pre-engineered design might be selected.

When the application involves more complex specifications or a larger fan, then a design based on an existing model configuration will often satisfy the requirements. Many model configurations already cover the range of current industry processes. An appropriate model from the fan company's catalogue is selected, and the company's engineers apply design rules to calculate the dimensions and select options and material for the desired performance, strength and operating environment.

Some applications require a dedicated, custom configuration for a fan design to satisfy all specifications.

All industrial fan designs must be accurately engineered to meet performance specifications while maintaining structural integrity. For each application, there are specific flow and pressure requirements. Depending on the application, the fan may be subject to high rotating speeds, an operating environment with corrosive chemicals or abrasive air streams, and extreme temperatures. Larger fans and higher speeds produce greater forces on the rotating structures; for safety and reliability, the design must eliminate excessive stresses and excitable resonant frequencies. Computer modeling programs for computational fluid dynamics (CFD) and finite element analysis (FEA) are often employed in the design process, in addition to laboratory scale model testing. Even after the fan is built the verification might continue, using fan performance testing for flow and pressure, strain gage testing for stresses and tests to record the fan's resonant frequencies.

Vocabulary.

Abrasive - a substance used for rubbing away the surface of something, usually to clean it or make it shiny (абразив, абразивный материал).

Applicable - affecting or relating to a person or thing (применимый, подходящий).

Configuration - the particular arrangement or pattern of a group of related things; the way in which all the equipment that makes up a computer system is set to operate, or when you ADJUST (=make small changes to) a computer system in a particular way (конфигурация).

Current - of the present time; a movement of water, air or electricity, in a particular direction (текущий, струя, поток).

Dimension - a measurement of something in a particular direction, especially its height, length, or width; a part or feature or way of considering something (размер, объем, измерение).

Excitable - easily and often becoming excited.

Gage - (gauge) an instrument that measures and gives a visual display of the amount, level, or contents of something; the diameter of a wire, fiber, tube, etc.; the thickness of sheet metal or plastic (размер, шаблон, лекало, эталон, измерять, взвесить).

Integrity - the quality of being whole and complete.

Maintain - to keep a road, machine, building, etc. in good condition (поддерживать, сохранять, содержать).

Option - one thing which can be chosen from a set of possibilities, or the freedom to make a choice (выбор).

Path - a set of actions, especially ones which lead to a goal or result (тропа, путь, траектория).

Resonant - clear and loud, or causing sounds to be clear and loud; making you think of a similar experience or memory (звучащий, звонкий).

Verification - the process of establishing the truth, accuracy, or validity of something (проверка, подтверждение).

Exercise 1. Answer the questions.

1. Is there only one path to determining a fan design for an application?
2. Do the application requirements of fans vary greatly in industry?
3. Describe the process of selecting an appropriate model of industrial fan.
4. Are the requirements special for each application?
5. What are the measures of safety and reliability?
6. How industrial fans are scientifically prepared and tested?

Exercise 2. Decide if the following statements are true or false.

1. Fan designs have diameters of around 4 feet (1.2 meters) or less. T/F.
2. Some applications require a dedicated, custom configuration. T/F.
3. Few model configurations cover the range of industry processes. T/F.
4. All industrial fans should maintain structural integrity. T/F.
5. Larger fans produce greater forces on the rotating structures. T/F.
6. CFD means computational fluid dynamics. T/F.
7. FEA means a finite element analysis. T/F.
8. Even after the fan is built the verification might continue. T/F.

Exercise 3. Translate the following sentences using the key words from the text above.

1. It was so hot in the car that I tried to fan myself with the road map.
2. She sat down and began fanning her face.
3. The new qualifications are applicable to all European countries.
4. The design has many applications.

5. The wheel rotates around an axle.
6. The satellite slowly rotates as it circles the Earth.
7. The human ear cannot hear very high-frequency sounds.

Exercise 4. Complete the following statements with your own ideas.

1. The way I see things…
2. I tend to think…
3. It seems to me that…
4. It's my feeling that…
5. In my experience…
6. It's my experience that…

Read and translate the text.

Boilers

A boiler is a closed vessel in which water or other fluid is heated. The fluid does not necessarily boil. (In North America, the term "furnace" is normally used if the purpose is not to actually boil the fluid.) The heated or vaporized fluid exits the boiler for use in various processes or heating applications, including water heating, central heating, boiler-based power generation, cooking, and sanitation.

What materials are used to make a boiler? The pressure vessel of a boiler is usually made of steel (or alloy steel), or historically of wrought iron. Stainless steel, especially of the austenitic types, is not used in wetted parts of boilers due to corrosion and stress corrosion cracking. However, ferrite stainless steel is often used in super heater sections that will not be exposed to boiling water, and electrically heated stainless steel shell boilers are allowed under the European "Pressure Equipment Directive" for production of steam for sterilizers and disinfectors.

In live steam models, copper or brass is often used because it is more easily fabricated in smaller size boilers. Historically, copper was often used for fireboxes (particularly for steam locomotives), because of its better formability and higher thermal conductivity; however, in more recent times, the high price of copper often makes this an uneconomic choice and cheaper substitutes (such as steel) are used instead.

For much of the Victorian "age of steam", the only material used for boiler making was the highest grade of wrought iron, with assembly by riveting. This iron was often obtained from specialist ironworks, such as at Creator Moor (UK), noted for the high quality of their rolled plate and its suitability for high-reliability use in critical applications, such as high-pressure boilers. In the 20th century, design practice instead moved towards the use of steel, which is stronger and cheaper, with welded construction, which is quicker and requires less labor. It should be noted, however, that wrought iron boilers corrode far slower than their modern-day steel counterparts, and are less susceptible to localized pitting and stress-corrosion. This

makes the longevity of older wrought-iron boilers far superior to those of welded steel boilers.

Cast iron may be used for the heating vessel of domestic water heaters. Although such heaters are usually termed "boilers" in some countries, their purpose is usually to produce hot water, not steam, and so they run at low pressure and try to avoid actual boiling. The brittleness of cast iron makes it impractical for high-pressure steam boilers.

Energy: the source of heat for a boiler is combustion of any of several fuels, such as wood, coal, oil, or natural gas. Electric steam boilers use resistance- or immersion-type heating elements. Nuclear fission is also used as a heat source for generating steam, either directly (BWR) or, in most cases, in specialized heat exchangers called "steam generators" (PWR). Heat recovery steam generators (HRSGs) use the heat rejected from other processes such as gas turbine.

Vocabulary.

Austenite - (Metallurgy) a solid solution of carbon in a non-magnetic form of iron stable at high temperatures. It is a constituent of some form of steel.

Boiler - a device that heats water by burning gas or oil, especially to provide heating and hot water in a house; the part of a steam engine where water is heated to provide power (бойлер, паровой котел).

Brittle - delicate and easily broken (ломкий, хрупкий).

Cast-iron - very strong (чугунный, стальной, железный).

Counterpart - a person or thing which has the same purpose as another one in a different place or organization (пара к чему-то, дополнение).

Fission - the splitting of the NUCLEUS of an atom, which results in the release of a large amount of energy, or the division of a living cell as part of reproduction (расщепление, деление).

Fluid - a substance which flows and is not solid; smooth and continuous. If situations, ideas or plans are fluid, they are not fixed and are likely to change, often repeatedly and unexpectedly. (Жидкость, жидкий, текучий, неопределенный, переменчивый).

Immerse - to put something or someone completely under the surface of a liquid (погрузить, окунать).

Immersion (heater) - a type of electric heater used for heating water (погружаемый нагреватель).

Longevity - living for a long time (долголетие, долговечность).

Riveting - extremely interesting (захватывающий).

Sanitation - the systems for taking dirty water and other waste products away from buildings in order to protect people’s health (санитарные условия, канализационная система).

Vaporize - to turn, or cause something to turn, from a solid or liquid state into gas (испарять).

Weld - to join two pieces of metal together permanently by melting the parts that touch (сваривать, спаивать).

Wrought iron - iron that can be bent into attractive shapes and used to make gates, furniture, etc. (сварочное/кованое железо).

Exercise 1. Answer the questions.

1. What is a boiler?
2. How does a boiler work?
3. What materials are used to make a boiler?
4. Why copper or brass is often used?
5. What is changed nowadays concerning usage of copper?
6. What metals are cheaper and can substitute copper?
7. What was the only material used in the Victorian "age of steam"?
8. What are the advantages of wrought iron boilers?
9. What is special about domestic water heaters?
10. What is the source of heat for a boiler?

Exercise 2. Find the opposites.

Closed, heated, opened, cooled, exit, steam, enter, water, never, often, easy, difficult, lower, worse, higher, better, cheap, weak, expensive, strong, fast, modern, slow, old, impractical, practical.

Exercise 3. Decide if the following statements are true or false.

1. A boiler is a closed vessel in which water or other fluid is heated. T/F.
2. The heated fluid exits the boiler for use in various processes. T/F.
3. The pressure vessel of a boiler is usually made of steel. T/F.
4. Ferrite stainless steel is often used in super heater sections. T/F.
5. Copper or brass is often used because it is more easily fabricated. T/F.
6. Recently, the high price of copper makes this an uneconomic choice. T/F.
7. Cheaper substitutes (such as steel) are used instead. T/F.
8. Wrought iron boilers corrode slower. T/F.
9. The brittleness of cast iron makes it impractical for steam boilers. T/F.
10. The source of heat for a boiler is combustion of any fuels. T/F.
11. Nuclear fission is also used as a heat source for generating steam. T/F.

Exercise 4. Translate the following sentences using the key words from the vocabulary above.

1. The pond was covered in a brittle layer of ice.
2. Can you give me a cast-iron guarantee that it will be completed on time?
3. The fission of the cell could be inhibited with certain chemicals.
4. The shells should be immersed in boiling water for two minutes.
5. To what do you attribute your longevity?
6. It was a riveting story.
7. Most meteorites striking the Earth vaporize instantly.
8. Iron spikes have been welded to the railings around the embassy.

Read and translate the text.

Thermal power stations

A thermal power station is a power plant in which heat energy is converted to electric power. In most of the places in the world the turbine 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; this is known as a Rankine cycle. The greatest variation in the design of thermal power stations is due to the different heat sources, fossil fuel dominates here, although nuclear heat energy and solar heat energy are also used. Some prefer to use the term energy center because such facilities convert forms of heat energy into electrical energy. Certain thermal power plants also are designed to produce heat energy for industrial purposes of district heating, or desalination of water, in addition to generating electrical power.

Almost all coal, nuclear, geothermal, solar, thermal, and waste incineration plants, as well as many natural gas power plants are thermal. Natural gas is frequently combusted in gas turbines as well as boilers. The waste heat from a gas turbine, in the form of hot exhaust gas, can be used to raise steam, by passing this gas through a Heat Recovery Steam Generator (HRSG) the steam is then used to drive a steam turbine in a combined cycle plant that improves overall efficiency. Power plants burning coal, fuel oil, or natural gas are often called fossil-fuel power plants. Some biomass-fueled thermal power plants have appeared also. Non-nuclear thermal power plants, particularly fossil-fueled plants, which do not use co-generation, are sometimes referred to as conventional power plants.

Commercial electric utility power stations are usually constructed on a large scale and designed for continuous operation. Virtually all electric power plants use three-phase electrical generators to produce alternating current (AC) electric power at a frequency of 50 Hz or 60 Hz. Large companies or institutions may have their own power plants to supply heating or electricity to their facilities, especially if steam is created anyway for other purposes. Steam-driven power plants have been used to drive most ships in most of the 20th century until recently. Steam power plants are now only used in large nuclear naval ships. Shipboard power plants usually directly couple the turbine to the ship's propellers through gearboxes. Power plants in such ships also provide steam to smaller turbines driving electric generators to supply electricity. Nuclear marine propulsion is, with few exceptions, used only in naval vessels. There have been many turbo-electric ships in which a steam-driven turbine drives an electric generator which powers an electric motor for propulsion.

Combined heat and power plants (CH&P plants), often called co-generation plants, produce both electric power and heat for process heat or space heating.

Vocabulary.

Alternating current - electrical CURRENT which regularly changes the direction in which it moves (переменный ток).

Biomass - dead plant and animal material suitable for using as fuel.

Cogeneration - the generation of electricity and useful heat jointly, especially the utilization of the steam left over from electricity generation for heating.

Couple - two or a few things that are similar or the same, or two or a few people who are in some way connected; to join or combine (пара, сцеплять, соединять, связывать).

Desalination - the removal of salt from sea water (опреснение (воды)).

Dominate - to have control over a place or a person, or to be the most important person or thing (доминировать, преобладать, подавлять, командовать).

Exhaust - the waste gas from an engine, especially a car's, or the pipe the gas flows through (выхлоп, отработанный газ).

Facilities - the buildings, equipment and services provided for a particular purpose (сооружение, условия, оборудование, помещение).

Fossil fuels - things like coal or oil, that come from plants or animals that are millions of years old (полезные ископаемые).

Frequency - the number of times something happens within a particular period, or the fact of something happening often or a large number of times; the number of times that a wave, especially a sound or radio wave, is produced within a particular period, especially one second; a particular number of radio waves produced in a second at which a radio signal is broadcast (частота, частотность).

Gearbox - a metal box containing the gears in a vehicle (коробка передач).

Incinerate - destroy (something, especially waste material) by burning (испепелять, сжигать дотла).

Naval - belonging to a country's navy, or relating to military ships (морской, военно-морской, флотский).

Overall - in general rather than in particular, or including all the people or things in a particular group or situation (полный, всеобщий).

Propulsion - a force that pushes something forward (движение вперед).

Spin - to (cause to) turn around and around, especially fast; (of a vehicle) to move quickly, or to move quickly in a vehicle (быстро вращаться, крутиться).

Steam - the hot gas that is produced when water boils (пар).

Supply - to provide something that is wanted or needed, often in large quantities and over a long period of time (снабжать, обеспечивать, питать).

Utility - a service which is used by the public, such as electricity or gas supply or a train service; the usefulness of something, especially in a practical way (полезность, практичность, выгодность).

Vessel - a large boat or a ship (корабль).

Exercise 1. Answer the questions.

1. What is a thermal power station?
2. Explain the process how the turbine works.

3. Is the design of thermal power stations different or the same?
4. Which plants are considered thermal?
5. What can you say about commercial electric utility power stations?
6. What types of electrical generators do electric power plants use?
7. Why do large companies or institutions may have their own power plants?
8. How did people use steam-driven power plants?
9. Where nuclear marine propulsion can be used?
10. What are co-generation plants and what do they produce?

Exercise 2. Decide if the following statements are true or false.

1. In a power plant heat energy is converted to electric power. T/F.
2. In most of the places in the world the turbine is steam-driven. T/F.
3. Not many prefer to use the term energy center. T/F.
4. Thermal power plants produce heat energy for industrial purposes. T/F.
5. Very few plants are thermal. T/F.
6. Only power plants burning coal are called fossil-fuel power plants. T/F.
7. Biomass-fueled thermal power plants have never been used before. T/F.
8. Non-nuclear thermal power plants are conventional power plants. T/F.
9. Steam-driven power plants are still used to drive most ships. T/F.
10. Nuclear marine propulsion is used only in naval vessels. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. Switch off the electric current before touching that machine.
2. We'll have to wait another couple of hours for the paint to dry.
3. He refuses to let others speak and dominates every meeting.
4. They work as a group- no one person is allowed to dominate.
5. How long will it be before the world's fuel supplies are exhausted?
6. Car exhaust is the main reason for the city's pollution.
7. The human ear cannot hear very high-frequency sounds.
8. Spiders spin webs.
9. We were spinning along, when suddenly one of our tires burst.
10. The pump is driven by steam.
11. Electrical power is supplied by underground cables.
12. Students are supplied with a list of books that they are expected to read.
13. Someone has turned off the electricity supply.
14. The remains of Roman earthenware vessels were found during the dig.

Read and translate the text.

Some words of history

The initially developed reciprocating steam engine has been used to produce mechanical power since the 18th century, with notable improvements being made

by James Watt. When the first commercially developed central electrical power stations were established in 1882 at Pearl Street Station in New York and Holborn Viaduct power station in London, reciprocating steam engines were used. The development of the steam turbine in 1884 provided larger and more efficient machine designs for central generating stations. By 1892 the turbine was considered a better alternative to reciprocating engines; turbines offered higher speeds, more compact machinery, and stable speed regulation allowing for parallel synchronous operation of generators on a common bus. After about 1905, turbines entirely replaced reciprocating engines in large central power stations.

The largest reciprocating engine-generator sets ever built were completed in 1901 for the Manhattan elevated railway. Each of seventeen units weighed about 500 tons and was rated 6000 kilowatts; a contemporary turbine set of similar rating would have weighed about 20% as much.

Vocabulary.

Alternative - something that is different from something else, especially from what is usual, and offering the possibility of choice (альтернатива).

Compact - consisting of parts that are positioned together closely or in a tidy way, using very little space (компактный, сжатый).

Contemporary - existing or happening now (современный).

Elevated - raised (высокий).

Engine - a machine that uses the energy from liquid fuel or steam to produce movement (двигатель, мотор).

Generator - a machine which produces something, especially electricity (производитель, генератор).

Notable - important and deserving attention, because very good or interesting (заметный, замечательный, выдающийся).

Rate - the speed at which something happens or changes, or the amount or number of times it happens or changes in a particular period (скорость).

Reciprocating engine - an engine in which one or more pistons move up and down in cylinders; a piston engine (поршневой двигатель).

Stable - firmly fixed or not likely to move or change (устойчивый, стабильный).

Synchronize - to (cause to) happen at the same time (синхронизировать, совпадать во времени).

Weigh - to have a heaviness of a stated amount, or to measure the heaviness of an object (взвешивать, вешать).

Exercise 1. Answer the questions.

1. How has the initially developed reciprocating steam engine been used?
2. Who made notable improvements of the reciprocating steam engine?
3. When were the first commercially developed power stations established?
4. Where were the first commercially developed power stations established?
5. How important was the development of the steam turbine in 1884?

6. Name all the advantages of the turbine by 1892.
7. What happened in 1905?
8. Where the largest reciprocating engine-generator sets were used in 1901?
9. How heavy were they in comparison with a contemporary turbine set?

Exercise 2. Decide if the following statements are true or false.

1. The reciprocating steam engine has been used since the 18th century. T/F.
2. James Watt made notable improvements of such engines. T/F.
3. The development of the steam turbine in 1884 was very important. T/F.
4. Turbines became more important than reciprocating steam engines. T/F.
5. Turbines entirely replaced reciprocating engines. T/F.
6. The largest reciprocating engines were for the Manhattan railway. T/F.

*Exercise 3***.** Translate the following sentences using the key vocabulary above.

1. Cars had compacted the snow until it was like ice.
2. Was he a contemporary of Shakespeare's?
3. She holds a more elevated position in the company.
4. This attractive building is particularly notable for its garden setting.
5. The taxi was going at a tremendous rate.
6. The show was designed so that the lights synchronized with the music.
7. We'd better synchronize our watches if we all want to be there in time.
8. Yesterday a satellite weighing 15 tons was successfully placed in orbit.
9. Your luggage must be weighed before it is put on the aircraft.

Read and translate the text.

Pumps

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.

Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power; come in many sizes, from microscopic for use in medical applications to large industrial pumps.

Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart.

Single stage pump - when in a casing only one impeller is revolving then it is called single stage pump.

Double/ multi stage pump - when in a casing two or more than two impellers are revolving then it is called double/ multi stage pump.

In biology, many different types of chemical and bio-mechanical pumps have evolved, and bio-mimicry is sometimes used in developing new types of mechanical pumps.

Mechanical pumps may be submerged in the fluid they are pumping or be placed external to the fluid.

Vocabulary.

Casing - a covering that protects something.

Displacement - the weight of liquid that is forced out of position by an object which is floating on or in it (вытеснение, водоизмещение).

Double - to become twice as much or as many, or to make something twice as much or many (удваивать).

Evolve - to develop gradually, or to cause something or someone to develop gradually (развиваться).

External - of, on, for or coming from the outside (внешний).

Impel - to make someone feel that they must do something (приводить в движение, принуждать, заставлять).

Revolving - describes something that revolves (=moves around a central point) (вращающийся).

Reciprocate - If a part of a machine reciprocates, it moves backwards and forwards (двигаться взад и вперед).

Rotary - (of a machine) having a part that moves around in a circle (вращающийся).

Slurry - a mixture of water and small pieces of solid, especially such a mixture used in an industrial or farming process (жидкое цементное тесто, жидкий строительный раствор).

Stage - a part of an activity or a period of development (стадия, фаза, этап).

Submerge - to go below the surface of the sea or a river or lake; to cover or hide something completely (погрузиться).

Via - through; using (через).

Exercise 1. Answer the questions.

1. What is a pump?
2. How can pumps be classified?
3. What is the principle of their classification?
4. Where can pumps operate?
5. Where do people apply mechanical pumps?
6. How do people use pumps in medical industry?
7. What is special about single stage pump?
8. What can you say about double/multi stage pumps?

9. Can pumps be used in biology?
10. Explain the proper position of mechanical pumps.

Exercise 2. Find the nouns in the following list of words.

Fluid, liquid, slurry, gravity, operate, perform, application, industrial, pumping, well, filtering, oil, cooling, operating, developing, manufacturing, casing, revolving, work, source, size.

Exercise 3. Decide if the following statements are true or false.

1. A pump is a device that moves fluids and slurries. T/F.
2. Pumps can be classified into two major groups. T/F.
3. Groups are classified according to the method to move the fluid. T/F.
4. Pumps operate via many energy sources. T/F.
5. There can be single and double stage pumps. T/F.
6. Mechanical pumps serve in a wide range of applications. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Company profits have doubled since the introduction of new technology.
2. The company has evolved into a multi-million dollar organization.
3. This cream is for external use only.
4. The Earth revolves around the sun.
5. His whole life revolves around football.
6. Some electric razors have reciprocating heads.
7. They did the last stage of their journey on foot.
8. The fruit was preserved by submersion in alcohol.
9. Reports are coming in via satellites.

Read and translate the text.

Classification of pumps

Pumps can be classified by their method of displacement into positive displacement pumps, impulse pumps, velocity pumps, gravity pumps, steam pumps and valveless pumps. There are two basic types of pumps: positive displacement and centrifugal. Although axial-flow pumps are frequently classified as a separate type, they have essentially the same operating principles as centrifugal pumps.

A heat pump is a device that transfers heat energy from a source of heat to a destination called a "heat sink". Heat pumps are designed to move thermal energy in the opposite direction of spontaneous heat flow by absorbing heat from a cold space and releasing it to a warmer one. A heat pump uses a small amount of external power to accomplish the work of transferring energy from the heat source to the heat sink.

While air conditioners and freezers are familiar examples of heat pumps, the term "heat pump" is more general and applies to many HVAC (heating, ventilating, and air conditioning) devices used for space heating or space cooling. When a heat pump is used for heating, it employs the same basic refrigeration-type cycle used by an air conditioner or a refrigerator, but in the opposite direction - releasing heat into the conditioned space rather than the surrounding environment. In this use, heat pumps generally draw heat from the cooler external air or from the ground.

In heating mode, heat pumps are three to four times more efficient in their use of electric power than simple electrical resistance heaters. Typically installed cost for a heat pump is about 20 times greater than for resistance heaters.

Vocabulary.

Axial - relating to or forming an axis; around an axis (осевой).

Centrifugal - (of a turning object) moving away from the point around which it is turning (центробежный).

Displacement - the weight of liquid that is forced out of position by an object which is floating on or in it (вытеснение, водоизмещение).

Gravity - the force which attracts objects towards one another, especially the force that makes things fall to the ground (сила притяжения, тяжесть).

Heat sink - a device or substance for absorbing excessive or unwanted heat.

Impulse - a short electrical, radio or light signal which carries information or instructions between the parts of a system (толчок, импульс).

Refrigerator - an appliance or compartment which is artificially kept cool and used to store food and drink. Modern refrigerators generally make use of the cooling effect produced when a volatile liquid is forced to evaporate in a sealed system in which it can be condensed back to liquid outside the refrigerator (холодильник).

Steam - the hot gas that is produced when water boils (пар).

Valve - a device which opens and closes to control the flow of liquids or gases, or similar structure in the heart and the veins, which controls the flow of blood (клапан, вентиль).

Velocity - the speed at which an object is travelling (скорость, быстрота).

Exercise 1. Answer the questions.

1. How pumps can be classified?
2. Name the two basic types of pumps.
3. Is there any other separate type?
4. Explain the work of a heat pump.
5. What is HVAC?
6. Air conditioners and freezers familiar examples of heat pumps?

Exercise 2. Decide if the following statements are true or false.

1. Pumps cannot be classified. T/F.
2. There are two basic types of pumps. T/F.
3. Axial-flow pumps are frequently classified as a separate type. T/F.

4. A heat pump is a device that transfers heat energy. T/F.
5. Heat pumps are designed to move thermal energy. T/F.
6. Air conditioners and freezers are familiar examples of heat pumps. T/F.
7. HVAC means heating, ventilating, and air conditioning devices. T/F.
8. Heat pumps are more efficient in their use than electrical heaters. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. Steam rose from the simmering stew.
2. The pump is driven by steam.
3. The bathroom mirror steamed up during my shower.
4. The valve failed to open/close.
5. Light travels at the highest achievable velocity in the universe.
6. Our latest machine can pump a hundred gallons a minute.
7. The new wine is pumped into storage tanks.

Read and translate the text.

Heat pump and refrigeration cycle

Heat energy naturally flows from warmer places to colder spaces. However, a heat pump can reverse this by absorbing heat from a cold space and releasing it to a warmer one. Heat is not conserved in this process and requires some amount of external energy such as electricity. In heating, ventilation and air conditioning (HVAC) systems, the term heat pump usually refers to vapor-compression refrigeration devices optimized for high efficiency in both directions of thermal energy transfer. These heat pumps can be reversible that work in either direction to provide heating or cooling to the internal space.

Heat pumps are used to transfer heat because less high-grade energy is required than is released as heat. Most of the energy for heating comes from the external environment, only a fraction of which comes from electricity (or some other high-grade energy source required running a compressor). In electrically-powered heat pumps, the heat transferred can be three or four times larger than the electrical power consumed, giving the system a coefficient of performance (COP) of 3 or 4, as opposed to a COP of 1 for a conventional electrical resistance heater, in which all heat is produced from input electrical energy.

Heat pumps use a refrigerant as an intermediate fluid to absorb heat where it vaporizes, in the evaporator, and then to release heat where the refrigerant condenses, in the condenser. The refrigerant flows through insulated pipes between the evaporator and the condenser, allowing for efficient thermal energy transfer at relatively long distances.

Vocabulary.

Absorb - to take something in, especially gradually (впитывать, поглощать).

Coefficient - a value, in mathematics, that appears in front of and multiplies another value (коэффициент).

Compressor - a (part of a) machine which presses gas or air into less space (компрессор).

Condense - to reduce something, such as speech or piece of writing, in length; to make a liquid thicker by removing some of the water; to change or make something change from a gas to a liquid or solid state (конденсировать, сгущать, конденсироваться).

Condenser - a piece of equipment that reduces gases to their liquid or solid form (конденсатор).

Evaporate - to cause a liquid to change to a gas, especially by heating; to disappear (испаряться).

Fraction - a number that results from dividing one whole number by another, or a small part of something (дробь, частица, крупица, фракция).

Input - something such as energy, money or information that is put into a system, organization or machine so that it can operate; the part that carries information to a machine, or the place where this is connected (вложение, вклад, ввод, вводить).

Insulate - to cover and surround something with a material or substance in order to stop heat, sound or electricity from escaping or entering; to protect someone or something from outside influences (отделять, изолировать, утеплять).

Release - to give freedom or free movement to someone or something; to move a device from a fixed position to allow it to move freely; to allow a substance to flow out from somewhere (освобождать, отпускать, выпускать).

Reverse - to (cause something to) go backwards, or change the direction, order, position, result, etc. of something to its opposite (поворачивать обратно, отменять, давать задний ход).

Reversible - If something is reversible, it can be changed back to what it was before. It can also describe clothes that can be worn so that the inside becomes the outside (обратимый, двусторонний).

Vapor - gas or extremely small drops of liquid which result from the heating of a liquid or solid (пар, туман, испарение).

Exercise 1. Answer the questions.

1. How does heat energy flow?
2. Is it possible to reverse it?
3. What is HVAC?
4. Explain how pumps can be reversible?
5. What are the sources of energy for heating?
6. What is an intermediate fluid that heat pumps use?
7. Where does the refrigerant flow?

*Exercise 2.*Find adjectives in the following list of words.

Heat, flow, reverse, conserved, heating, reversible, direction, cooling, released, thermal, provide, consumed, input, insulated, condenser.

Exercise 3. Decide if the following statements are true or false.

1. Heat energy naturally flows from warmer places to colder spaces. T/F.
2. Heat pumps can be reversible. T/F.
3. Heat pumps are used to transfer heat. T/F.
4. Most of the energy for heating comes from electricity. T/F.
5. Heat pumps use a refrigerant as an intermediate fluid. T/F.
6. The refrigerant flows through insulated pipes. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Plants absorb carbon dioxide.
2. In cold climates, houses need to have walls that will absorb heat.
3. Towels absorb moisture.
4. Water vapor in the air condenses into fog.
5. Plants keep cool during summer by evaporating water from their leaves.
6. The power input will come largely from hydroelectricity.
7. I've spent the morning inputting data into the computer.
8. You can insulate a house against heat loss.
9. Coal power stations release sulphur dioxide into the atmosphere.
10. To go backwards, you must put the car into reverse (gear).
11. The hollow glass tank contains hot mercury vapor.
12. Poisonous vapors burst out of the factory during the accident.

Read and translate the text.

Steam engine

A steam engine is a heat engine that performs mechanical work using steam as its working fluid.

Steam engines are external combustion engines, where the working fluid is separate from the combustion products. Non-combustion heat sources such as solar power, nuclear power or geothermal energy may be used. The ideal thermodynamic cycle used to analyze this process is called the Rankine cycle. In the cycle, water is heated and transforms into steam within a boiler operating at a high pressure. When expanded through pistons or turbines, mechanical work is done. The reduced-pressure steam is then condensed and pumped back into the boiler.

In general usage, the term steam engine can refer to either the integrated steam plants (including boilers etc.) such as railway steam locomotives and portable engines, or may refer to the piston or turbine machinery alone, as in the beam engine and stationary steam engine. Specialized devices such as steam hammers and

steam pile drivers are dependent on the steam pressure supplied from a separate boiler.

Vocabulary.

External - of, on, for or coming from the outside (внешний).

Fluid - a substance which flows and is not solid (жидкость).

Hammer - a tool with a heavy metal head mounted at right angles at the end of a handle, used for jobs such as breaking things and driving in nails; a machine with a metal block for giving a heavy blow to something (молоток, молот).

Pile driver - a machine for driving piles into the ground (копер).

Stationary - not moving or not intended to be moved (неподвижный, закрепленный, стационарный, постоянный, неизменный).

Steam - the vapor into which water is converted when heated, forming a white mist of minute water droplets in the air; the invisible gaseous form of water, formed by boiling, from which this vapor condenses; the expansive force of this vapor used as a source of power for machines; locomotives and railway systems are powered in this way (пар).

Steam engine - an engine that uses the expansion or rapid condensation of steam to generate power; steam locomotive (паровой двигатель).

Steam hammer - a large steam-powered hammer used in forging (паровой молот).

Steam heat - heat produced by steam, especially by a central heating system in a building or on a train or ship that uses steam (отдаваемое паром тепло).

Thermodynamics - the branch of physical science that deals with the relations between heat and other forms of energy (such as mechanical, electrical, or chemical energy), and, by extension, of the relationships and interconvertibility of all forms of energy (термодинамика).

Exercise 1. Answer the questions.

1. What is a steam engine?
2. Name non-combustion heat sources.
3. What is the Rankine cycle?
4. Could you explain this process?
5. Would you explain the term steam engine?
6. What devices are dependent on the steam pressure?

Exercise 2. Decide if the following statements are true or false.

1. A steam engine is a heat engine that performs mechanical work. T/F.
2. Steam engines are not external combustion engines. T/F.
3. The integrated steam plants are only railway steam locomotives. T/F.
4. Steam hammers and steam pile drivers are specialized devices. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. Externally, she appeared calm, but inside she was furious.
2. If you have a fever you should drink plenty of fluid(s).
3. Can you hold this nail in position while I hammer it into the door?
4. The traffic got slower and slower until it was stationary.
5. The train/ship steamed out of the station/harbor.
6. The Romans first recognized the medical benefits of thermal springs.

Read and translate the text.

From the history of steam engines

The use of boiling water to produce mechanical motion goes back over 2000 years, but early devices were not highly practical. The Spanish inventor Jerónimo de Ayanz y Beaumont obtained the first patent for a steam engine in 1606. In 1698 Thomas Savery patented a steam pump that used steam in direct contact with the water being pumped. Savery's steam pump used condensing steam to create a vacuum and draw water into a chamber, and then applied pressurized steam to further pump the water. Thomas Newcomen's atmospheric engine was the first commercial true steam engine using a piston, and was used in 1712 for pumping in a mine.

In 1781 James Watt patented a steam engine that produced continuous rotary motion. Watt's ten-horsepower engines enabled a wide range of manufacturing machinery to be powered. The engines could be sited anywhere that water and coal or wood fuel could be obtained. By 1883, engines that could provide 10,000 hp had become feasible. The stationary steam engine was a key component of the Industrial Revolution, allowing factories to locate where water power was unavailable. The atmospheric engines of Newcomen and Watt were large compared to the amount of power they produced, but high-pressure steam engines were light enough to be applied to vehicles such as traction engines and the railway locomotives.

Reciprocating piston type steam engines remained the dominant source of power until the early 20th century, when advances in the design of electric motors and internal combustion engines gradually resulted in the replacement of reciprocating (piston) steam engines in commercial usage, and the ascendancy of steam turbines in power generation. Considering that the great majority of worldwide electric generation is produced by turbine type steam engines, the "steam age" is continuing with energy levels far beyond those of the turn of the 19th century.

Vocabulary.

Ascendancy - a position of power, strength or success (власть, господство).

Beyond - further away in the distance (than something); outside or after (a stated limit) (за, после, вне).

Chamber - a closed space in a machine (палата, комната).

Horsepower - a unit for measuring the power of an engine (лошадиная сила).

Piston - a short solid piece of metal which moves up and down inside a cylinder in an engine to press the fuel into a small space and to send the power produced by it to the wheels (поршень, пистон).

Pressurized - If a container is pressurized, the air pressure inside it is higher than the air pressure outside it (герметизированный).

Reciprocating engine - an engine in which one or more pistons move up and down in cylinders; a piston engine.

Rotary - (of a machine) having a part that moves around in a circle (вращающийся).

Site - a place where something is, was, or will be built, or where something happened, is happening, or will happen; to exist or be built in a particular place (местоположение, местонахождение, располагать, размещать).

Traction engines - a steam or diesel-powered road vehicle used (especially formerly) for pulling very heavy loads.

Unavailable - If someone is unavailable, they are not able to talk to people or meet people, usually because they are doing other things. If something is unavailable, you cannot get it or use it (не имеющийся в наличии).

Vacuum - a space from which most or all of the air, gas or other material has been removed or is not present (вакуум, безвоздушное пространство, пустота).

Exercise 1. Answer the questions.

1. How old is the use of boiling water?
2. Who obtained the first patent for a steam engine? When?
3. Who patented a steam pump using steam in direct contact with the water?
4. How did Savery's steam pump work?
5. What device was the first commercial true steam engine using a piston?
6. When did James Watt patent a steam engine?
7. Where the engines could be sited, in what conditions?
8. What was a key component of the Industrial Revolution?
9. What remained the dominant source of power of the early 20th century?
10. Was it the end of the "steam age"? Why not?

Exercise 2. Decide if the following statements are true or false.

1. Early devices were not highly practical. T/F.
2. The Spanish inventor obtained the first patent for a steam engine. T/F.
3. The atmospheric engine was the first commercial true steam engine. T/F.
4. Watt's engines enabled manufacturing machinery to be powered. T/F.
5. Stationary steam engine was major for the Industrial Revolution. T/F.
6. Reciprocating piston steam engines were used until the 20th century. T/F.
7. The "steam age" continued far beyond the turn of the 19th century. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. In the distance, beyond the river, was a small town.

2. We cannot allow the work to continue beyond the end of the year.
3. Her beauty is beyond compare.
4. Aircraft cabins are pressurized.
5. Some electric razors have reciprocating heads.

Read and translate the text.

Heat power stations in Almaty

Joint Stock Company "Almaty power stations" is a power generation company engaged in heat and electric power production in the city of Almaty and Almaty region. Being a holder of natural monopoly on heat energy production provides the population, industrial and agricultural enterprises with electric power and heat. It was established by the Resolution No. 92 of "KazTransGas', dated May 23, 2006 and was registered under state registration number of legal entities 78188-1910-AO on June 01, 2006. Currently, the company is a part of "Samruk-Energo", JSC Group of Companies. The organizational structure includes 8 production departments.

Production departments are as follows: – CHP Plant 1 – electric power and heat production; – CHP Plant 2 – electric power and heat production; – CHP Plant 3 – electric power and heat production; – Kapchagay hydroelectric power plant – electric power production; – hydroelectric power chain – electric power production; –West heat complex (WHC) – heat energy production; – industrial repair company "Energoremont" (IRC) – repair of equipment. Fuel reception and discharge center (FRDC) – reception and discharge of fuel for energy sources.

Exercise 1. Answer the questions.

1. What can you say about the company "Almaty power stations"?
2. Where is this company situated?
3. What do people receive from it?
4. When was it established?
5. Is this company a branch of another one?
6. How many production departments does it include?
7. Name all of them.
8. What is WHC? How do you translate it in Russian?
9. What is IRC? How do you translate it in Russian?
10. What is FRDC? How do you translate it in Russian?

Exercise 2. Decide if the following statements are true or false.

1. "Almaty power stations" is a power generation company. T/F.
2. It is engaged in heat and electric power production in Almaty. T/F.
3. It provides the population with electric power and heat. T/F.
4. The organizational structure includes 8 production departments. T/F.

Read and translate the text.

History of “Almaty power stations”

Joint Stock Company “Almaty power stations” was established by the Resolution No. 92 of “KazTransGas”, dated May 23, 2006 and was registered under state registration number of legal entities 78188-1910-AO on June 01, 2006. Currently, the company is a part of “SamrukEnergo”, JSC Group of Companies.

“Almaty power stations” is a power generation company engaged in heat and electric power production in the city of Almaty and Almaty region. The generated heat and power supply now covers 70 % of needs of the city of Almaty and Almaty region. “Almaty power stations” was included into the Republican section of the State register of subjects of natural monopolies (it is a holder of natural monopoly on heat power production).

The engineering and construction of Alma-Ata central power plant (nowadays, CHP Plant 1) was begun in 1931. The first facility was put under industrial load on October 25, 1935. CHP Plant 1 includes the following main equipment: – six power boiler units BKZ-160-100; – seven water-heating boilers PTVM-60-90/ 13; – two steam turbines PT-60-90/13; – one steam turbine P-25-90/18.

The equipment was put into operation from 1960 to 1996.The construction of Almaty CHP Plant 2 was begun in 1974. During the period from 1980 to 1983 three steam boilers BKZ-420-140-7C and three steam turbines PT-80/100-130/13 were commissioned. The second phase of construction works was performed from 1985 to 1989. CHP Plant 2 includes the following equipment: – seven power boiler units BKZ-420-140-7c; – three steam turbines PT-80-130/13; – two steam turbines T-110-130; – one steam turbine P-50-130/13.

The equipment was put into operation from 1980 to 1989. The project of the first phase of Alma-Ata state district power plant (currently, CHP Plant 3) construction with a capacity of 100 thousand kW was approved by the Resolution of the Alma-Ata council of national economy on December 9, 1959. The construction was begun in 1957. CHP Plant 3 includes the following main equipment: six power boiler units BKZ-160-100; three steam turbines T-41-90; one steam turbine K-50-90.The equipment was put into operation from 1960 to 1967. The foundations of West heat complex (WHC) were laid on November 26, 1963. In the same year two water-heating boilers were installed and commissioned and during the period from 1964 to 1967 one more water-heating and five steam boilers were put into operation. Currently, WHC includes the following main equipment: – three steam boilers BO-25/15; – two steam boilers GM-50/14; – two water-heating boilers PTVM-50; six water-heating boilers PTVM-100; – four water-heating boilers KVGM-100.

The equipment was put into operation from 1963 to 1988. Kapchagay HEP Plant was designed by Kazakh branch of all-union scientific research and design institute “Hydroproject” named after S. Ya. Zhouk. In 1959 there was a further

modification of the project during the period from 1961 to 1964. The management board of Kapchagay HEP Plant under construction was formed in 1965 by the Decree No. 266-P of the council of ministers of the Kazakh SSR dated February 25, 1965, and thus its construction was began. In 1980 the construction of Kapchagay HEP Plant was finished and the acceptance certificate was signed by the state commission.

Exercise 1. Answer the questions.

1. How large is the generated heat and power supply by the company?
2. How old is CHP plant 1?
3. What main equipment does this plant include?
4. When was the equipment put into operation?
5. What other sort of equipment was added?
6. What was special about CHP plant 3?
7. What can you say about Kapchagay HEP Plant?

Exercise 2. Decide if the following statements are true or false.

1. Generated heat and power supply covers 70 % of needs of the city. T/F.
2. The company holds natural monopoly on heat power production. T/F.
3. The construction of Almaty CHP Plant 2 was begun in 1974. T/F.
4. The construction of Almaty CHP Plant 3 was begun in 1957. T/F.
5. The foundations of West heat complex were laid in 1963. T/F.
6. Kapchagay HEP Plant was designed by all-union scientific institute. T/F.
7. In 1980 the construction of Kapchagay HEP Plant was finished. T/F.

Read and translate the text.

Central heating system

A central heating system provides warmth to the whole interior of a building (or portion of a building) from one point to multiple rooms. When combined with other systems in order to control the building climate, the whole system may be an HVAC (heating, ventilation and air conditioning) system.

Central heating differs from space heating in that the heat generation occurs in one place, such as a furnace room in a house or a mechanical room in a large building (though not necessarily at the "central" geometric point). The heat is distributed throughout the building, typically by forced-air through ductwork, by water circulating through pipes, or by steam fed through pipes.

The most common method of heat generation involves the combustion of fossil fuel in a furnace or boiler. Increasingly, buildings utilize solar-powered heat sources, in which case the distribution system normally uses water circulation.
In much of the temperate climate zone, most detached housing has come with central heating installed since the Second World War, at least. Such areas normally use gas heaters, district heating, or an oil-fired system, often using forced-

air systems. Steam-heating systems, fired by coal, oil or gas, are also used, primarily for larger buildings. Electrical heating systems occur less commonly and are practical only with low-cost electricity or when ground source heat pumps are used. Considering the combined system of thermal power station and electric resistance heating, the overall efficiency will be less than for direct use of fossil fuel for space heating.

Vocabulary.

Circulation - when something such as information, money or goods passes from one person to another (циркуляция).

Detached - separated (отдельный).

Duct - a tube or pipe that carries liquid or air, especially in and out of buildings or through the body (канал, проток).

Forced - done against your wishes; describes an action which is done because it is suddenly made necessary by a new and usually unexpected situation (принужденный, вынужденный, ворваться).

Occur - to happen; to exist or be present in, among, etc. (случаться, происходить).

Pipe - a tube inside which liquid or gas flows from one place to another (труба, трубка).

Primary - more important than anything else; main (основной).

Temperate - neither very hot or nor very cold (умеренный).

Utilize - to use something in an effective way (использовать, утилизировать).

Exercise 1. Answer the questions.

1. What is a function of a central heating system?
2. What is an HVAC?
3. Is there a difference between central heating and space heating?
4. What is the most common method of heat generation?
5. What can you say about electrical heating systems?
6. Why don’t people use electrical heating systems so often?

Exercise 2. Decide if the following sentences are true or false.

1. A central heating system provides warmth to the whole building. T/F.
2. An HVAC means heating, ventilation and air conditioning. T/F.
3. The heat is distributed by forced-air through ductwork. T/F.
4. The heat is distributed by water circulating through pipes. T/F.
5. Heat generation involves combustion of fossil fuel in a furnace. T/F.
6. In case of solar-powered heat sources water circulation is used. T/F.
7. In temperate climate zone, central heating is installed in houses. T/F.
8. Electrical heating systems occur less commonly. T/F.
9. Electrical heating systems are practical with low-cost electricity. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. Exercise helps to improve circulation.
2. The label became detached from your parcel.
3. Most office buildings have dozens of air ducts and vents.
4. The airplane had to make a forced landing.
5. An accident involving ten vehicles has occurred in the east-bound lane.
6. Sensible utilization of the world's resources is a priority.

Read and translate the text.

Energy sources for a central heating system

The energy source selected for a central heating system varies by region. The primary energy source is selected on the basis of cost, convenience, efficiency and reliability. The energy cost of heating is one of the main costs of operating a building in a cold climate. Some central heating plants can switch fuels for reasons of economy and convenience; for example, a home owner may install a wood-fired furnace with electrical backup for occasional unattended operation.

Solid fuels such as wood, peat or coal can be stockpiled at the point of use, but are inconvenient to handle and difficult to automatically control. Wood fuel is still used where the supply is plentiful and the occupants of the building don't mind the work involved in hauling in fuel, removing ashes, and tending the fire. Pellet fuel systems can automatically stoke the fire, but still need manual removal of ash. Coal was once an important residential heating fuel but today is rarely found.

Liquid fuels are petroleum products such as heating oil and kerosene. These are still widely applied where other heat sources are unavailable. Fuel oil can be automatically fired in a central heating system and requires no ash removal and little maintenance of the combustion system. However, the variable price of oil on world markets leads to erratic and high prices compared to some other energy sources. Institutional heating systems (office buildings or schools, for example) can use low-grade, inexpensive bunker fuel to run their heating plants, but capital cost is high compared to more easily manage liquid fuels.

Natural gas is a widespread heating fuel in North America and northern Europe. Gas burners are automatically controlled and require no ash removal and little maintenance. However, not all areas have access to a natural gas distribution system. Liquified petroleum gas or propane can be stored at the point of use and periodically replenished by a truck-mounted mobile tank.

Some areas have low cost electric power, making electric heating economically practical. Electric heating can either be purely resistance-type heating or make use of a heat pump system to take advantage of low-grade heat in the air or ground.

A district heating system uses centrally located boilers or water heaters and circulates heat energy to individual customers by circulating hot water or steam.

This has the advantage of a central highly efficient energy converter than can use the best available pollution controls, and that is professionally operated. The district heating system can use heat sources impractical to deploy to individual homes, such as heavy oil, wood byproducts, or (hypothetically) nuclear fission. The distribution network is more costly to build than for gas or electric heating, and so is only found in densely populated areas or compact communities.

Not all central heating systems require purchased energy. A few buildings are served by local geothermal heat, using hot water or steam from a local well to provide building heat. Such areas are uncommon. A passive solar system requires no purchased fuel but needs to be carefully designed for the site.

Vocabulary.

Ash - the soft grey or black powder that is left after a substance, especially tobacco, coal or wood, has burnt (зола, пепел).

Erratic - not regular, uncertain or without organization in movement or behavior (неустойчивый, беспорядочный).

Haul - to pull something heavy slowly and with difficulty (тащить).

Nuclear fission - the splitting of the nucleus of tan atom, which results in the release of a large amount of energy, or the division of a living cell as part of reproduction (атомный распад).

Peat - a dark brown substance like soil which was formed by plants dying and becoming buried. It is sometimes added to ordinary garden earth to improve it and sometimes used as fuel (торф).

Pellet - a small hard ball or tube-shaped piece of any substance (шарик).

Replenish - to fill something up again (пополнять).

Stockpile - to store a large supply of something for future use (запасать).

Stoke - to add fuel to a large closed fire and move the fuel around with a stick so that it burns well and produces a lot of heat (топить).

Unattended - not being watched or taken care of (никем не сопровождаемый, оставленный без надзора).

Exercise 1. Answer the questions.

1. What is the energy source for a central heating system, can it vary?
2. What solid fuels can you name?
3. Are solid fuels convenient sources of energy?
4. What liquid fuels can you name?
5. Are they still widely applied?
6. In what countries is natural gas a widespread heating fuel?
7. What heat sources does a district heating system use?
8. What are the types of energy that we do not have to purchase?

Exercise 2. Find the nouns in the following list of words.

Convenience, efficiency, reliability, wood, control, fuel, liquid, require, remove, energy, distribution, heat, pump, circulating, heater, district, compact, purchased, geothermal, well, solar.

Exercise 3. Decide if the following statements are true or false.

1. The energy source for a central heating system varies by region. T/F.
2. Pellet fuel systems can automatically stoke the fire. T/F.
3. Coal was once an important residential heating fuel. T/F.
4. Liquid fuels are petroleum products such as heating oil and kerosene. T/F.
5. District heating systems use centrally located boilers. T/F.
6. Not all central heating systems require purchased energy. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. The machine is working erratically- there must be a loose connection.
2. The fission of the cell could be inhibited with certain chemicals.
3. Does your glass need replenishing?
4. Once the fire had been stoked up, the room began to get warm.
5. Please do not leave your luggage unattended.

Read and translate the text.

Non-traditional renewable sources of energy

It is known that much is being done in the world today for the development of non-traditional sources of energy.

Without them the Earth cannot support its present population of 5 billion people and probably 8 billion people in the 21^{st} century. Now we are using traditional power sources, that is, oil, natural gas, coal, and water power with the consumption of more than 50 billion barrels per year. It is evident that these sources are not unlimited. That is why it is so important to use such renewable sources of energy as the sun, wind, geothermal energy and others. Research is being carried out in these fields. One of the most promising researches is the development of power stations with direct transformation of solar energy into electricity on the basis of photo-effect. It was Russia that was the first in the world to develop and test a photoelectric battery of 32,000 volts and effective area of only 0.5 m^2, which made it possible to concentrate solar radiation. This idea is now being intensively developed in many countries. However, the efficiency of a solar power station is considerably reduced because of the limited time of its work during the year. But it is possible to improve the efficiency of solar power stations by developing different combinations of solar power stations and traditional ones - thermal, atomic and hydraulic .Today some engineers are working at the problem of developing electric power stations with the use of a thermal-chemical cycle. It will operate on products of the transformation of solar energy, whereas the «solar» chemical reactor uses $C0_2$ and water steam of the thermal power station. The result is that we have a closed

cycle. In Kamchatka there are geothermal power stations operating on hot water-steam mixture from the depths of about a kilometer. In some projects water will be heated by the warmth of mountains at a depth of four - five km. It is planned that plants working on the energy of the solar heat provided by the sun will be built on a larger scale.

That different wind energy plants are being developed is also well-known.

These energy plants can be small (of several kilowatts) and large powerful systems. It is important that all these advances in developing new sources of energy and improving the old ones help to solve the energy problem as a whole and they do not have negative effects on the environment.

Exercise 1. Answer the questions.

1. Do people try to find new non-traditional sources of energy?
2. Name the traditional power sources.
3. How large is their consumption per year?
4. Are these sources unlimited?
5. Name the types of renewable sources of energy.
6. What is one of the most promising researches?
7. What country was the first to develop a photoelectric battery?
8. Is this idea now being intensively developed in many countries?
9. Why the efficiency of a solar power station is considerably reduced?
10. Is it possible to improve the efficiency of solar power stations?
11. How will electric power stations with a thermal-chemical cycle operate?
12. Where are geothermal power stations with hot water-steam mixture?
13. What other energy plants are being developed?
14. What size can they have?
15. Are all these advances can have a negative effect on the environment?

Read and translate the text.

Heat power stations in Kazakhstan

The Ust-Kamenogorsk hydroelectric power plant is a hydroelectric power plant on the Irtysh River near Ust-Kamenogorsk in the East of Kazakhstan. It has 4 individual turbines with a nominal output of 82.8 MW with a generating capacity of 339.4 MW and generates 1.58 billion kilowatt-hours of electricity per year. It is owned and operated by AES Corporation.

The Bukhtarma hydroelectric power plant is a hydroelectric power plant on the Irtysh River 5 km upstream of the town of Serebryansk, in the East of Kazakhstan. “Bukhtarma” or “Buqtyrma” is a Kazakh word that can be translated as “ambush, blocking”.

The plant has 9 individual turbines with a total generating capacity of 675 megawatts and generates 2.77 billion kilowatt-hours of electricity per year. The plant is operated by Kazzinc under a long-term concession. It is integrated into

Kazakhstan's national electricity system and is used as a peak producer to regulate supply.

The Kapshagay hydroelectric power plant is a hydroelectricity power plant on the Ili River in Almaty. Constructed between 1965 and 1970, it has four individual turbines with a nominal output of around 91 MW which will deliver up to 364 MW of power and generates 972 million kilowatt-hours of electricity per year.

The Shulbinsk hydro-power plant is in the middle of the Irtysh River 70 km up the stream from Semipalatinsk in the East of Kazakhstan. It has 6 individual turbines, which will deliver up to 702 MW of power and generates 1.66 billion kilowatt-hours of electricity per year. It is owned and operated by AES Corporation.

Exercise 1. Answer the questions.

1. Where is the Ust-Kamenogorsk hydroelectric power plant situated?
2. Describe the system of its work.
3. Where is the Bukhtarma hydroelectric power plant situated?
4. Explain the system of its work.
5. How is “Bukhtarma” or “Buqtyrma” translated from Kazakh language?
6. Where is the Kapshagay hydroelectric power plant situated?
7. When was it constructed?
8. How much electricity does it generate per year?
9. Where is the Shulbinsk hydro-power plant situated?
10. How powerful is this plant?

Read and translate the text.

Heat engineering degree and certificate program information

Heat engineering is an academic specialty of mechanical engineering focused on thermal sciences. Students who want to study heat engineering typically do so through a graduate mechanical engineering degree or certificate program.

Emphasizing topics such as structural dynamics and engineering analysis. Graduates may be prepared to build careers in mechanical engineering. Students who want to improve their technical capabilities can choose a graduate certificate program that emphasizes radiation heat transfer and fluid mechanics.

Doctoral program students typically must have undergraduate degrees. They study topics such as advanced engineering dynamics in preparation for careers as professors, researchers or upper-level managers. In instances in which licenses are required, applicants must pass comprehensive examinations in order to qualify.

Students in graduate mechanical engineering programs with a concentration in thermal sciences learn about the laws of thermodynamics, as well as methods of heat transfer through radiation, conduction and convection. Thermal engineering students often collaborate with researchers in other university departments, such as

in chemistry and aerospace engineering. Students are able to opt for a thesis track or a coursework-only option.

Doctoral students in mechanical engineering programs can focus on the sub-discipline of fluid and thermal dynamics to learn about statistical physics, system analysis and multi-scale modeling. Research from this field is applicable to practical problems, like avoiding overheating of materials traveling in space or minimizing resource usage in home heating.

Vocabulary.

Aerospace engineering - the branch of technology and industry concerned with both aviation and space flight (аэрокосмическая инженерия).

Applicable - affecting or relating to a person or thing (применимый, подходящий).

Avoid - to stay away from someone or something, or prevent something from happening or not allow yourself to do something (объезжать, избегать, уклоняться).

Collaborate - to work with someone else for a special purpose (сотрудничать).

Comprehensive - complete and including everything that is necessary (всеобъемлющий, исчерпывающий).

Conduction- the process by which heat or electricity goes through a substance (проводимость, кондукция).

Conduction of heat - (теплопроводность).

Convection - the flow of heat through a gas or a liquid (конвекция).

Dynamics - the branch of mechanics concerned with the motion of bodies under the action of forces (динамика, движущая сила).

Emphasize - to show or state that something is very important or worth giving attention to (подчеркивать, делать упор на что-то).

Fluid mechanics - using a liquid to transmit power.

Opt for - to make a choice, especially for one thing or possibility in preference to any others (выбирать, выбрать).

Overheat - to (cause to) become hotter than necessary or wanted (перегреваться).

Qualify - to successfully finish a training course so that you are able to do a job; to have or achieve the necessary skills, etc; to have the legal right to have or do something because of the situation you are in, or to cause someone to have such a right; to succeed in getting into a competition (иметь право).

Radiation - the emission of energy as electromagnetic waves or as moving subatomic particles, especially high-energy particles which cause ionization; the energy transmitted in this way (радиация, излучение).

Statistical physics - a branch of physics concerned with large numbers of particles to which statistics can be applied.

Thermodynamics - the branch of physical science that deals with the relations between heat and other forms of energy (such as mechanical, electrical, or chemical

energy), and, by extension, of the relationships and interconvertibility of all forms of energy. The first law of thermodynamics states the equivalence of heat and work and reaffirms the principle of conservation of energy. The second law states that heat does not of itself pass from a cooler to a hotter body. Another, equivalent, formulation of the second law is that the entropy of a closed system can only increase. The third law (also called Nernst's heat theorem) states that it is impossible to reduce the temperature of a system to absolute zero in a finite number of operations (термодинамика).

Exercise 1. Answer the questions.

1. What can you say about a specialty of heat engineering?
2. What do doctoral program students study?
3. What do students in graduate mechanical engineering programs learn?
4. What do doctoral students in mechanical engineering programs learn?

Read and translate the text.

Popular career options

According to the U.S. bureau of labor statistics (BLS) in 2015, approximately 278,340 mechanical engineers were employed in various businesses; materials engineers held about 27,040 jobs in the same period (www.bls.gov). The most significant employment levels for mechanical engineering professionals were in the architectural, research and development fields, as well as aerospace and motor vehicle parts manufacturing industry. Materials engineers most commonly found employment in aerospace product manufacturing, architectural services and semiconductor manufacturing.

Materials engineers were projected to have a job growth of 1% from 2014-2024, stated the BLS, which placed increases in these engineering disciplines as slower than national job growth at large. Mechanical engineers expect a job growth of 5% in the same period. Growth was expected to come from the manufacturing community's increased use of nontraditional, composite materials created through nanotechnology and biotechnology research. The BLS stated that mechanical engineers earned a mean annual wage of $88,190 in May 2015; the mean annual wage of materials engineers was reported to be $94,690 for the same period.

Students who earn a heat engineering degree or certificate will study courses such as solids mechanics, structural dynamics, and fluid mechanics. Although licensing is not required, there is an exam that graduates can take to become licensed.

*Exercise 1.*Answer the questions.

1. How many mechanical engineers were employed in 2015?
2. What were the employment levels for engineering professionals?
3. Where did materials engineers find employment?

4. How much did mechanical engineers earn annually in May 2015?
5. What courses will heat engineering students study?

Read and translate the text.

Energy conservation

Energy conservation is efforts made to reduce the consumption of energy by using less of an energy service. This can be achieved either by using energy more efficiently (using less energy for a constant service) or by reducing the amount of services used (for example, by driving less). Energy conservation is a part of the concept of eco-sufficiency. Energy conservation reduces the need for energy services, and can result in increased environmental quality, national security, personal financial security and higher savings. It is at the top of the sustainable energy hierarchy. It also lowers energy costs by preventing future resource depletion.

Some countries employ energy or carbon taxes to motivate energy users to reduce their consumption. Carbon taxes can allow consumption to shift to nuclear power and other alternatives that carry a different set of environmental side effects and limitations. Meanwhile, taxes on all energy consumption stand to reduce energy use across the board, while reducing a broader array of environmental consequences arising from energy production. The State of California employs a tiered energy tax whereby every consumer receives a baseline energy allowance that carries a low tax. As usage increases above that baseline, the tax is increasing drastically. Such programs aim to protect poorer households while creating a larger tax burden for high energy consumers.

Vocabulary.

Array - a large group of things or people, especially one which is attractive or causes admiration and often one which has been positioned in a particular way; to arrange a group of things in a particular way (множество, выстраивать, выставлять).

Baseline - an imaginary line used as a starting point for making comparisons.

Conservation - the protection of plants and animals, natural areas, and interesting and important structures and buildings, especially from the damaging effects of human activity; carefully using valuable natural substances that exist in limited amounts in order to make certain that they will be available for as long a time as possible (сохранение, охрана).

Consumption - the amount used or eaten (потребление, поглощение).

Depletion - reduction (истощение, исчерпывание).

Energy conservation - (энергосбережение).

Hierarchy - a system in which people or things are arranged according to their importance (иерархия).

Saving - the money which you keep in an account in a bank or similar financial organization; an amount of money that you do not need to spend (экономия, сбережения).

Shift - to (cause something or someone to) move or change from one position or direction to another, especially slightly (смещать, двигать, перемещать).

Sufficiency - an amount of something that is enough for a particular purpose (достаточность, достаток).

Sustainable - able to continue over a period of time; causing little or no damage to the environment and therefore able to continue for a long time (поддерживать, переносить, выдерживать).

Tax - (an amount of) money paid to the government, which is based on your income or the cost of goods or services you have bought (налог).

Exercise 1. Answer the questions.

1. What is energy conservation?
2. Energy conservation is a part of what concept?
3. What are advantages and disadvantages of energy conservation?
4. How can government motivate energy users to reduce their consumption?
5. What is special in programs aim to protect poorer households?

Exercise 2. Decide if the following statements are true or false.

1. Energy conservation is the reduction of the consumption of energy. T/F.
2. Using energy efficiently is using less energy for a constant service. T/F.
3. Using energy efficiently is to reduce the amount of services used. T/F.
4. Energy conservation reduces the need for energy services. T/F.
5. Energy conservation can result in increased environmental quality. T/F.
6. Energy conservation can result national security. T/F.
7. Energy conservation can result personal financial security. T/F.
8. Energy conservation can result higher savings. T/F.
9. Energy conservation lowers energy cost. T/F.
10. Energy conservation prevents future resource depletion. T/F.
11. The State of California employs a tiered energy tax. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. There was a splendid array of food on the table.
2. They sat before an array of microphones and cameras.
3. A large number of magazines were arrayed on the stand.
4. Energy conservation reduces your fuel bills and helps the environment.
5. To cut down on fuel consumption we should have fewer cars on the road.
6. The movie was not intended for public consumption.
7. Increased expenditure has caused depletion in our capital/funds.
8. He spent all his savings on an expensive car.
9. She shifted uneasily from one foot to the other.

10. The wind is expected to shift (to the east) tomorrow.
11. Media attention has shifted recently onto environmental issues.
12. In cars that are automatics, you don't have to bother with shifting gears.
13. The meeting was held to promote sustainable development in the world.
14. They're putting up the tax on cigarettes.
15. Tax cuts (=reduction in taxes) are always popular.
16. What do you earn before/after tax (=tax on the money you earn)?

Read and translate the text.

Heat supply

Heat supply deals with the provision of heat to residential, public, and industrial buildings and structures. It also meets customers' residential (heating, ventilation, and hot-water supply) and industrial needs. A distinction is made between building and district heat supply. Building heat supply systems serve one or several buildings; district systems serve a residential or industrial area. In the USSR, district heat supply has proved most important; therefore, the Russian term «teplosnabzhenie» is ordinarily used in reference to district heat supply systems. The principal advantages of district heat supply over building heat supply are significant reductions in fuel expenditures and operating costs (for example, by automation and increase deficiency of boiler units), the possibility of using low-grade fuel, reduction of air pollution, and improvement of health conditions in populated areas.

A district heat supply system includes a source of heat, the heat supply system, and the heat-consuming installations, which are connected to the system through heat distribution points. With district heat supply, the sources of heat may be district heat and power plants, which combine the production of electricity and thermal energy; large boiler units, which produce only thermal energy; devices to recycle the thermal waste of industry; or installations to harness the heat of geothermal sources. In building heat supply, the sources of heat may be furnaces, hot-water boilers, or water heaters, including solar heaters.

In district heat supply, the heat-transport medium is usually water at temperatures up to 150°C or steam under pressures of 0.7–1.6 mega Newton's per m^2 (7–16 technical atmospheres). Water is usually used for municipal and domestic purposes, while steam is used for industrial purposes. The temperature and pressure in heat supply systems are determined by customer requirements and economic considerations. The cost of the higher temperatures and pressures of the transport medium becomes more justifiable the longer the distance of heat transport. The distances over which heat is transported in modern district heat supply systems reach several dozen kilometers. The consumption of standard fuel per unit of heat delivered is determined principally by the efficiency of the heat supply source. Current development of heat supply systems concentrates on increasing the capacity

of the heat source and the unit capacities of installed equipment. The thermal capacity of modern district heat and power plants reaches 2–4 tera calories per hour, and that of regional boiler installations is 300–500 giga calories per hour. In some heat supply systems, several sources of heat are used together to feed a common heat supply net; this technique increases reliability, flexibility, and economy.

Vocabulary.

Capacity - the total amount that can be contained or produced, or (especially of a person or organization) the ability to do a particular thing (мощность, нагрузка).

Consideration - when you think about something carefully (рассмотрение).

Distinction - a difference between two similar things; the quality of being special or different (отличие, различие, особенность, своеобразие).

Expenditure - the total amount of money that a government or person spends; the act of using or spending energy, time or money (расход, трата).

Feed - to supply something to a person or thing, or put something into a machine or system, especially in a regular or continuous way; to put fuel on or inside something that burns, to keep it burning (питать).

Flexible - able to change or be changed easily according to the situation; able to bend or to be bent easily without breaking (эластичный, гибкий).

Giga - used to form words with the meaning 1000 000 000 (гига).

Heat supply - (теплоснабжение).

Justifiable - If something is justifiable, there is a good reason for it (оправданный).

Medium - a method or way of expressing something; a substance that something grows in, lives in, or moves through (средство, материал, среда).

Ordinarily - usually (обычно, обыкновенно).

Populate - If an area is populated by people or animals, they live in that area; to live in an area or place (населять, заселять).

Requirement - something that you must do, or something you need (нужда, потребность, требование, условие).

Residential - A residential road, area, etc. has only private houses, not offices and factories (жилой).

Tera - used in units of measurement.

Thermal - connected with heat (восходящий поток теплого воздуха).

Exercise 1. Answer the questions.

1. How useful is heat supply?
2. What is a distinction between building and district heat supply?
3. What is the principal advantage of district heat supply?
4. What does a district heat supply system include?
5. What are the sources of heat in buildings?
6. What is the heat-transport medium in district heat supply?
7. How temperature and pressure is in heat supply systems are determined?

8. How far is heat transported in modern district heat supply systems?
9. Where does current development of heat supply systems concentrate on?
10. Is it good to use several sources of heat together?

Exercise 2. Decide if the following statements are true or false.

1. A distinction is made between building and district heat supply. T/F.
2. Building heat supply systems serve one or several buildings. T/F.
3. District systems serve a residential or industrial area. T/F.
4. A district heat supply system includes only a source of heat. T/F.
5. In building heat supply, the sources of heat may be only furnaces. T/F.
6. In district heat supply, the heat-transport medium is usually water. T/F.
7. Water is usually used for municipal and domestic purposes. T/F.
8. Steam is used for industrial purposes. T/F.

Exercise 3. Find the nouns among the following list of words and translate them.

Supply, residential, public, heating, distinction, heat, district, reduction, expenditure, improvement, installation, harness, furnace, solar, purpose, steam, pressure, distance, modern, reach, efficiency, capacity, source, equipment, reliability, flexibility, and economy.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. The generators each have a capacity of (=can produce) 1000 kilowatts.
2. The larger cars have bigger capacity engines.
3. Comfort/safety is an important consideration.
4. There is a clear distinction between the dialects spoken in the two regions.
5. The expenditure of effort on this project has been enormous.
6. They told the story through the medium of dance.
7. The river is populated mainly by smaller species of fish.
8. Students who fail to meet the requirements (of the course) will fail.

Read and translate the text.

Energy resources and engineering technology

What is hydroelectric power? Water from fast-running rivers is another source of energy, by building large dams to control the water; millions of kilowatts of power can be produced. Countries like Sweden and Norway get most of their electricity from hydroelectric power.

Solar and wind energy, what are they? In the future much of our energy may come from the sun. In some countries, solar collectors on the roof can already create enough solar power to heat and provide electricity for a house in both winter and summer. One day we may also see small windmills on every roof. Even a small

wind can provide enough power to run lights and most electrical machines in the home.

Electrical engineering technology (EET) is an engineering technology field that implements and applies the principles of electrical engineering. Like electrical engineering, EET deals with the «design, application, installation, manufacturing, operation and/or maintenance of electrical/electronic(s) systems». However, EET is a specialized discipline that has more focus on application, theory, and applied design, and implementation, while electrical engineering may focus more of a generalized emphasis on theory and conceptual design. Electrical/electronic engineering technology is the largest branch of engineering technology and includes a diverse range of sub-disciplines, such as applied design, electronics, embedded systems, control systems, instrumentation, telecommunications, and power systems.

Exercise 1. Answer the questions.

1. What is hydroelectric power?
2. Which countries get most of their electricity from hydroelectric power?
3. Solar and wind energy, what are they?
4. How powerful are solar collectors on the roofs of the houses?
5. How powerful will be windmills on every roof of a house?
6. What is EET?
7. What does this engineering technology field deal with?
8. What is it focused on?
9. What sub-disciplines does this branch of engineering technology include?

Exercise 2. By means of adding of a suffix form adjectives from the following list of words.

Apply, emphasize, technology, electricity, engineer, wind, power, population, region, resident, increase, reduce, industry, environment, ecology, atmosphere, consume, pollution, achieve.

Part 2

Read and translate the text.

Future energy

Right now, all over the world, people are using energy. As we drive our cars, work on our computers, or even cook food on a wood fire, we probably do not stop to think about where the energy comes from.

But when the gas is gone and there is no more coal -what will happen then?

Gas goes across the earth in great pipes. Oil and coal travel from one country to another in big ships, often for thousands of miles. We do not think about this when we take a cold drink from the fridge, or turn on a light. Energy has always been there when we wanted it.

But the clock is ticking. The oil, coal, and gas will not last forever. Scientists are working hard to find new ways to get energy, and some of their ideas will surprise you. A car that sails with the wind, a turbine at the bottom of a river, machines that use the heat from people's bodies — these are some of the places that the energy of the future will come from. And that future is not far away...

At this moment around the world, billions of lights, computers, TVs, and fridges are turned on. At any moment of any day, 25 million cars are driving on roads and nearly 700 000 people are flying somewhere in a plane. Most of the energy that we use for these things comes from fuels like coal, oil, and natural gas. One day soon, we will not have any more of these fuels. Where will our energy come from in the future, and how will this change our world?

Scientists are finding new answers all the time. Get ready for the children whose running feet make the energy to bring water to their village; for the power station that uses warm and cold water to make energy; for the car that saves energy by growing like a plant…

Vocabulary.

Aluminum- алюминий.

Carbon dioxide- двуокись углерода, углекислота, углекислый газ.

Carbon monoxide- угарный газ.

Coal- a hard black substance that comes from under the ground and gives out heat when you burn it (каменный уголь, уголь).

Fuel- anything that you burn to make heat or power (топливо, горючее).

Gas- something like air that you burn to cook or make heat (газ).

Hydrogen- водород.

Light bulb- the glass part of an electric lamp that gives light (электрическая лампочка).

Methane- метан.

Oil- a thick liquid from under the ground that we use for energy (нефть).

Oxygen- кислород.

Power station- a building where electricity is produced (электростанция).

Silicon- кремний.

Turbine- a machine that gets its power from a wheel that is turned by water or air (турбина).

Uranium- уран.

Exercise 1. Answer the questions.

1. How do people use energy?
2. What are the traditional sources of energy?
3. Are these sources of energy unlimited?
4. Who is working hard to find new ways to get energy?
5. Give some examples of such new ways.
6. Where will our energy come from in the future?
7. Give some more examples of new ways to get energy.

Exercise 2. Match the chemicals with the definitions: Aluminum (Al), Carbon dioxide (CO_2), Carbon monoxide (CO), Hydrogen (H), Methane (CH_4), Oxygen (O), Silicon (Si), Uranium (U), Zinc (Zn).

1. This light metal is used to make things like planes.
2. This gas can kill you.
3. This is a fuel in a nuclear power station.
4. This is the lightest gas and the smallest atom.
5. This is a gas which people use to cook.
6. This gas is made when things burn.
7. This gas is something we need to live.
8. This metal is found in your body and used in batteries.
9. This is used to make an important computer part.

Exercise 3. How much do you know about energy? Three of these sentences are true. Which are they?

1. The first factories used machines called steam engines. T/F.
2. Most of the world's energy comes from nuclear power. T/F.
3. You can make fuel for cars from plants. T/F.
4. People did not use wind power until the 1970 years. T/F.
5. Iceland gets most of its energy from burning coal. T/F.
6. Your body produces enough energy for a 100W light. T/F.

Read and translate the text.

Fossil fuels

For thousands of years, people made things with their hands. They used the power of the wind, water, and animals to travel, move, or build things. Most people burnt wood to heat their homes and to cook. Then, in October 1765, a young engineer called James Watt built a machine that changed the world - a steam engine.

To make a steam engine work, coal is burnt to heat water, and this makes steam. The steam goes into the engine and moves the parts inside it. There were steam engines before 1765, but Watt's new engine worked much better and could move big machines in factories. Soon people began to build factories everywhere.

In the next hundred years, lots of new factory machines were invented. They made new products for people to buy. Suddenly our houses were full of new things. In many countries, thousands of people left their villages and moved to the cities to work in the factories. Poor workers worked long hours with dangerous machines, and life was very hard for them. Smoke from the burning coal filled the air in the towns.

The first steam train was built in 1804. By 1850, trains and ships with steam engines were carrying passengers around the world. In the 1880 years, the first power stations were built. They burnt coal to make steam for huge machines called

steam turbines. When steam turbines move, they turn parts in machines called generators, which use this movement to make electricity. Soon electric lights appeared on the streets and people had electric power at home.

In 1885, German engineer Karl Benz invented the first car. It used a new type of engine and a new type of fuel: petrol. Petrol burnt inside the engine to make the parts move, and this made it much smaller than a steam engine. Twenty years later, factories were producing thousands of cars every year, and new roads crossed the land. Most of these cars used petrol, which comes from oil. In 1903, Orville and Wilbur Wright used a petrol engine to fly the world's first aero plane.

Things like the steam engine, electricity, and the car changed the lives of everyone on earth. They also changed the way that we get energy. Today about 87 per cent of the world's energy comes from burning coal, oil, and natural gas. Where do these fuels come from, and how do we use them today?

Coal, oil, and natural gas come from things that were alive millions of years ago. Oil and natural gas come from animals that lived in the sea. Coal comes from plants that lived in wet places, such as land next to rivers or lakes. Over millions of years, far under the ground, they changed into coal, oil, and natural gas. We call these kinds of fuel fossil fuels, and the oldest ones are about 400 million years old!

Vocabulary.

Coal - a hard black substance that comes from under the ground and gives out heat when you burn it (каменный уголь, уголь).

Electricity - power that can make heat and light (электричество).

Fuel - anything that you burn to make heat or power (топливо, горючее).

Fossil fuel - fuel like coal or oil that comes from animals or plants millions of years old (полезные ископаемые).

Gas - something like air that you burn to cook or make heat (газ).

Generator - a machine for producing electricity (генератор).

Light bulb - the glass part of an electric lamp that gives light (электрическая лампочка).

Oil - a thick liquid from under the ground that we use for energy (нефть).

Petrol - the liquid that you put in a car to make it go (бензин).

Power - strength; the supply of electricity; to supply energy or electricity to something (сила, мощь, энергия).

Steam - the gas that water becomes when it gets very hot (пар).

Turbine - a machine that gets its power from a wheel that is turned by water or air (турбина).

Exercise 1. Answer the questions.

1. What power did people use for thousands of years?
2. What happened in October 1765?
3. Explain the work of a steam engine.
4. Were there steam engines before 1765?
5. Why did people begin to build factories everywhere?

6. Why did people leave their villages and move to the cities?
7. Was life very hard for the workers at the factories?
8. When was the first steam train built?
9. When were the first power stations built?
10. Explain the principle of work of a steam turbine and a generator.
11. When was the first car invented? Who was the inventor?
12. What type of engine and fuel did it use?
13. Who flew the world's first aero plane? When did it happen?
14. What things changed the lives of everyone on earth?
15. Where do fossil fuels come from, and how do we use them today?

Exercise 2. Circle the correct words.

1. A plane's engines burn a lot of *fuel/energy.*
2. At this moment, billions of machines are *produced/ turned on.*
3. *Generators/Turbines* change movement into electricity.
4. Karl Benz used a *steam/petrol* engine in the first car.
5. Fossil fuels come from *rocks/living things.*
6. The Romans used coal to make *metals/chemicals.*
7. We can use tankers and *wells/pipes* to move oil and gas around the world.

Read and translate the text.

Coal

We have used coal for a long time. Two thousand years ago, the Roman people used it to heat their homes and make metals. We still use coal for these things today, but most coal is burnt in power stations to make electricity. About 40 per cent of the world's electricity comes from coal. Every week, somewhere in the world, a new power station that burns coal is built!

To make the electricity that your fridge uses in one year, you need about 300 kilograms of coal! The biggest coal power stations burn 10—15 million tons of coal every year. A lot of that coal comes in ships from thousands of kilometers away.

In some places, we get this coal from huge holes on the surface of the earth. In other places, the coal comes from hundreds of meters under the ground. There is not much room to move, and the temperature can be 40 °C or more.

It is difficult to get enough clean air and often too noisy to speak. Getting the coal from under the ground is dirty, dangerous work, but millions of people do it every day. Every year, about 5,000 of them die.

*Exercise 1.*Answer the questions.

1. How old is the history of using coal?
2. How do people use it today and for what purpose?
3. What is the per cent of using coal for generating electricity?
4. What is the consumption of coal for the biggest coal power stations?

5. How do people deliver coal from thousands of kilometers away?
6. What are the conditions of getting coal from under the ground?
7. Are the coal holes deep?
8. Is it a dangerous work to get coal from under the ground?
9. Can people die doing it?

Read and translate the text.

Oil

In places like Saudi Arabia, Nigeria, and Venezuela, there are lakes of oil, called oil fields, under the ground. To get the oil, people drill holes in the ground called oil wells. Some of these wells are several kilometers deep! In other places, huge machines called oil platforms drill wells under the sea. There are often bad storms at sea, so oil platforms have to be very strong. Under the water, some platforms are as tall as skyscrapers - the world's tallest buildings.

Countries with oil fields send the oil to other countries in long pipes, or in huge ships called oil tankers. The world's biggest oil tankers can carry 440 million liters of oil - that is as heavy as 350,000 family cars!

Oil contains many chemicals. The tankers take it to factories where it is heated and cooled to get the different chemicals from it. Some of these chemicals are used to make things like plastic or clothes. However, about 85 per cent of the oil is made into fuels. There are different types of fuel for engines in cars, ships, and planes. The factories also make fuel for heating buildings, and for burning in power stations to make electricity.

Every year, we make about 60 million new cars and thousands of ships and planes - so every year we need more and more oil.

Exercise 1. Answer the questions.

1. In what countries of the world are there lakes of oil?
2. How are lakes of oil called?
3. What should people do to get the oil?
4. How are holes in the ground called?
5. How deep are these wells?
6. Why do oil platforms have to be very strong?
7. How tall are some platforms under the water?
8. What are skyscrapers?
9. How do countries with oil fields send the oil to other countries?
10. How many liters of oil can the world's biggest oil tankers carry?
11. How oil can be used and what chemicals does it contain?
12. Are all types of fuel the same?
13. Why do people need more and more oil?

Read and translate the text.

Natural gas

About 2,000 years ago, people in China made pipes from tall bamboo plants. They used them to drill wells and find natural gas hundreds of meters under the ground. The pipes carried the gas to their homes, where they used it for gas lights and heating water.

Today we burn natural gas in factories and power stations. We also use it in homes for heating and cooking. There are even cars and buses which drive on natural gas instead of petrol. Natural gas is the cleanest fossil fuel: it produces much less pollution than burning coal or oil.

When a person in Britain cooks something, the natural gas that they use may come from Norway, Russia, or Kazakhstan. How do they get the gas from these places? Often the gas goes through pipes. One gas pipe under the sea from Norway to Britain is 1,200 kilometers long! In other places, the gas is cooled to make it into a liquid. This liquid gas is put in ships called gas tankers.

A lot of the world's natural gas is found inside a type of rock called shale. In the past, it was too difficult and expensive to get the gas from inside the rock. Now in places like Pennsylvania, in the USA, people are using water to break the shale rocks under the ground and get the gas. In the first ten weeks of 2011, three hundred new gas wells were drilled in the USA. The problem is that each well will produce millions of liters of polluted water. You have to clean all this water or keep it somewhere safe.

It is always the same story. Today shale gas is the newest fossil fuel to bring good things for some people - new jobs and money - and bad things for others - pollution from dirty water. In rich countries, fossil fuels have made it possible for most people to live a very comfortable life. Will they destroy that life one day too?

*Exercise 1.*Answer the questions.

1. How old is the history of using natural gas?
2. How did people use it in the past?
3. How do people use it today?
4. Why is natural gas considered as the cleanest fossil fuel?
5. Which countries send natural gas?
6. How do they get the gas from these places?
7. What is the other way of delivering natural gas?
8. Where is a lot of the world's natural gas found?
9. Is it difficult and expensive to get natural gas nowadays?
10. What is the new way nowadays and is it safe?
11. Does shale gas bring only good things for people?
12. Can fossil fuels help people to live a very comfortable life?
13. Will they destroy that life one day too?

Read and translate the text.

Energy and our planet

In the waters of the Gulf of Mexico, between Mexico and the USA, there are more than 2,300 oil platforms. On 20 April 2010, oil workers were drilling on one platform when gas from the well exploded. The oil platform was destroyed and eleven workers died. After the accident, oil started to escape from the well at the bottom of the sea.

It took two months for people to close the well. In that time, nearly 800 million liters of oil went into the sea. Ugly, black oil polluted beaches for hundreds of kilometers. Many birds and sea animals died, and people who worked in tourist and fishing businesses lost their jobs.

As the world's population grows, we need more and more energy. To find enough coal, oil, and natural gas, people are digging and drilling deeper. Energy companies are searching for fossil fuels in places like Alaska and the Amazon. But pollution and accidents can cause great damage to these beautiful natural places.

Burning fossil fuels produces dangerous gases. Some of them pollute our cities and damage people's health. Every year, about 2 million people die because of air pollution. Scientists think that other gases, like carbon dioxide (CO_2), are changing the world's climate. If a plane flies from Singapore to Los Angeles and back, its engines produce about 7 tons of CO_2 for every passenger on the plane.

Since the steam engine was invented, the amount of CO_2 in the air has grown by 35 per cent. CO_2 catches heat from the sun, so this makes the climate warmer. Because of this, in some places there is less rain than there used to be. Farmers cannot grow enough food, and forests are burning in the hot, dry weather. In other places, there is now too much rain: terrible floods destroy farms and houses.

On high mountains and in the Arctic and Antarctic, warmer weather is heating the ice and snow and changing it to water. This means that more water is going into the sea, so the sea is getting higher. Islands around the world are starting to disappear under the sea. Cities on the coast, like Shanghai, Dubai, and Venice, may disappear one day too.

Many living things are dying because a hotter climate is changing the places where they live. From the forests of Costa Rica to the ice of the Arctic Ocean, the land is changing and animals are disappearing. The facts are frightening: every day the world loses about 150 different types of plants or animals.

At the moment, the richest countries in the world use most of the energy and produce most of the pollution. For example, the USA has only 5 per cent of the world's population, but in any year it uses about 25 per cent of the entire world's energy. It also produces about 45 per cent of the world's CO_2. Australia produces more carbon pollution per person than any other country. But as other countries get richer, their populations want more things like TVs, computers, and cars — and that means they are starting to use more and more energy to produce and run them.

Around the world we use about 12 billion liters of oil, 19.8 billion kilograms of coal, and 10 billion cubic meters (m^3) of natural gas every day. But scientists

think that forty or fifty years from now, there will be no more oil. About twenty years after that, we will have no natural gas. Finally, in about 120 years, we will finish all of the world's coal. One day, all the fossil fuels will be gone.

We do not need to use fossil fuels: there are lots of other ways to produce energy. The problem is that most of the world's car engines, heating machines, and power stations were built to use fossil fuels. Changing this will take a long time, so a lot of people want to try to save energy too. The good news is that there are lots of ways to do this.

Vocabulary.

Accident - something bad which happens that is not expected or intended, and which often damages something or injures someone (несчастный случай, крушение, авария).

Beach - an area of sand or small stones near the sea or another area of water such as lake (пляж, взморье).

Catch - to take hold of something, especially something that is moving through the air (ловить, поймать, хватать, схватить).

Damage - to harm or spoil something (повреждать, вредить, причинять вред).

Dig - to break up and move soil using a tool, a machine or your hands; to form a hole by moving soil (копать, рыть).

Disappear - If people or things disappear, they go somewhere where they cannot be seen or found (исчезать, пропадать).

Drill - a tool that you use for making holes (дрель, бур, бурав, сверлить, бурить).

Enough - as much as is necessary; in the amount or to the degree needed; as much as or more than is wanted (достаточно).

Escape - to get free from something, or to avoid something (избегать, избежать).

Explode - to (cause to) break up into pieces violently (взрываться).

Flood - when there is a flood, a lot of water covers the land (наводнение, половодье, разлив).

Heat - to make something hot or warm, or to become hot or warm (нагревать, накалять, горячить).

High - greater than the usual level or amount (высокий).

Ugly - unpleasant to look at; not attractive; unpleasant or threatening or violent (уродливый, безобразный, некрасивый, опасный).

Well - a deep hole in the ground where people get water or oil (колодец, нефтяная скважина, источник).

Exercise 1. Answer the questions.

1. How many oil platforms are there in the waters of the Gulf of Mexico?
2. What happened on 20 April 2010?
3. What happened after the accident?

4. How many months did it take to close the well?
5. What were the consequences of the accident?
6. Where do people try to search fossil fuels?
7. Is it dangerous to burn warmer fossil fuels?
8. CO_2 causes warmer weather, is it dangerous for the planet?
9. Which countries use most of the energy?
10. How long can people use oil, coal and natural gas?
11. Are there other ways to produce energy?

Exercise 2. Decide if the following statements are true or false.
1. As the world's population grows, we need more and more energy. T/F.
2. Pollution can cause great damage to these beautiful natural places. T/F.
3. Burning fossil fuels produces dangerous gases. T/F.
4. Some of them pollute our cities and damage people's health. T/F.
5. The amount of CO_2 in the air has grown by 35 per cent. T/F.
6. CO_2 catches heat from the sun, so this makes the climate warmer. T/F.
7. Warmer weather is heating the ice and snow, changing it to water. T/F.
8. Islands around the world are starting to disappear under the sea. T/F.
9. One day, all the fossil fuels will be gone. T/F.
10. The richest countries of the world use more and more energy. T/F.
11. There are lots of ways to try to save energy. T/F.

Exercise 3. Write numbers to complete the sentences.
1. Air pollution kills about_____ million people a year.
2. There is_____ per cent more CO_2 in the air today.
3. _____ types of animals and plants disappear every day.
4. The world uses about_____ billion liters of oil daily.
5. Europeans waste more than _____ dollars of food every year.
6. People in Greece throw away_____ million plastic bottles every day.

Read and translate the text.

Saving energy

About half of the energy that we produce is wasted. Electricity is lost in power cables and cars waste fuel as they wait in traffic. Governments can save energy by building better power stations, for example, but we can help a lot too. What can we do to save energy?

Cars: on the Santa Monica Freeway, in Los Angeles, thousands of people are trying to get to work, but they are going nowhere. A driver in Los Angeles spends about 70 hours a year in traffic that is not moving. While long lines of cars wait under the hot Californian sun, their engines are producing dangerous gases. Drivers look angrily at their watches. Sometimes, you cannot see the sun in Los Angeles

because of all the pollution in the air! It is the same every morning in Sao Paulo, Moscow, Bangkok, and many other cities.

What about other ways to travel? Walking and cycling to work or school are great ways to save energy and stay healthy as well. If you cannot cycle or walk somewhere, you can still save energy if you take a train or bus instead of driving. In a lot of cities, people are joining car-sharing groups; each person in the group drives their friends to work one day a week. Everyone saves petrol and money, and there are fewer cars on the road.

Food: all the time, millions of tons of food are moving around the world, and this uses huge amounts of energy. Of course, you cannot grow tea in Iceland or rice in Qatar, so we have to buy food from other countries. It is great to eat Italian spaghetti or enjoy a hot cup of Kenyan coffee, but it is also good to think about where some of the food on our table comes from. If we want to save energy, we can try to buy more things that were produced in our country. In Turkish supermarkets, for example, you can buy bananas from Anamur, in Turkey, or from Ecuador, which is 12,000 kilometers away.

People say «You should not go into a supermarket when you feel hungry», and it is probably true. Supermarkets are full of fantastic things, and it is easy for hungry shoppers to buy more food than they really need. In European countries each family throws away more than 1,000 dollars of food every year - 20 to 25 per cent of all the food that they buy. Some of that unwanted food has come in ships from the other side of the world. So next time you go shopping, it may be a good idea to eat something first!

Vocabulary.

Angry - having a strong feeling against someone who has behaved badly, making you want to shout at them or hurt them (сердитый, разгневанный).

Cable - a strong thick metal rope (канат, трос, кабель).

Cycle- to ride a bicycle (ездить на велосипеде).

Huge - extremely large in size or amount (огромный, громадный, грандиозный).

Instead - in place of someone or something else (взамен, вместо).

Nowhere - in, at or to no place, not anywhere (нигде, никуда).

Pollution- damage caused to water, air, etc. by harmful substances or waste (загрязнение).

Power - strength; the supply of electricity; to supply energy or electricity to something (сила, мощь, энергия).

Rice - the small seeds of a particular type of grass, which are cooked and eaten as food (рис).

Save - to stop someone or something from being killed, injured or destroyed (беречь).

Share - If two or more people share an activity, they each do some of it (делить, разделять, распределять).

Ship - a large boat for travelling on water, especially across the sea (корабль).

Spend - to use energy, effort, force, etc. especially until there is no more left (расходовать, истощать).

Tea - (a drink made by pouring hot water onto) dried and cut leaves and sometimes flowers, especially the leaves of the tea plant (чай).

Throw away - to get rid of something that you do not want any more (выбрасывать, выбросить).

Travel - to make a journey, usually over a long distance (путешествовать, ездить).

Unwanted - not wanted (нежеланный).

Walking - the activity of going for a walk, especially for pleasure in the countryside (ходьба).

Waste - unwanted matter or material of any type, often that which is left after useful substances or parts have been removed (отходы, отбросы, мусор).

Exercise 1. Answer the questions.

1. What can we do to save energy?
2. Are traffic jams dangerous for atmosphere?
3. What are other ways to travel?
4. Is it a good idea to buy more things that were produced in our country?
5. Why don't you have to go into a supermarket when you feel hungry?

Exercise 2. Find the words of opposite meaning.

Wasted, move, stored, save, stop, angry, lose, kind, healthy, few, sick, many, bad, empty, cold, full, hot, good.

Exercise 3. Decide if the following statements are true or false.

1. About half of the energy that we produce is wasted. T/F.
2. Governments can save energy by building better power stations. T/F.
3. Drivers spend about 70 hours a year in traffic that is not moving. T/F.
4. Walking and cycling to work or school are great ways to save energy. T/F.
5. In a lot of cities, people are joining car-sharing groups. T/F.
6. We eat food from all over the world. T/F.
7. If we are hungry we buy more food than we need. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. I don't understand what he's angry about.
2. The road has been dug up in order to lay cables.
3. We did a lot of cycling in France last year.
4. His last three films have all been huge successes.
5. There's no coffee - would you like a cup of tea instead?
6. Bad manners will get you nowhere (=will not help you to succeed).
7. Once nicotine has you in its power, it's very difficult to stop smoking.

8. Do you prefer brown rice or white rice?
9. You'll save time if you take the car.
10. Shall we share the driving?
11. How much did you spend?
12. How do you like your tea – strong or weak?
13. So when are you going to throw away those old magazines?
14. I travel to work by train.
15. We're going walking in Wales for a week.
16. You waste a lot of water by having a bath instead of a shower.

Read and translate the text.

Energy at home and the problem of rubbish

Imagine two power stations working 24 hours a day, 365 days a year. That is how much energy people in Britain waste by leaving things like TVs on standby (turned on and ready to use). Did you know that leaving a TV on standby all day can use the same amount of power as watching it for an hour? How many machines are on standby in your house? Can you turn any of them off?

When you turn on a normal light bulb, only 10 per cent of the electricity it uses turns into light — the other 90 per cent is wasted as heat. Using energy-saving light bulbs saves 80 per cent of that electricity, and you can use them for much longer too.

Do you like to heat your house to 26 °C in the winter or cool it to 18 °C in the summer? Half of the energy that we use at home is used to heat or cool the house. You can save a lot of energy if you keep your house at 22 °C all year and put on warmer or cooler clothes. It also takes a lot of energy to heat water. When you make a hot drink, it is good to heat just as much water as you need, not more.

And now let us observe the problem of rubbish. Every day, people in Greece throw away 8 million plastic bottles. Around the world we produce millions of tons of rubbish every year. Some of this rubbish is recycled, but most of it is thrown into big holes in the ground. Rubbish like this may be dangerous for animals and people for hundreds of years.

Recycling an old aluminum drinks container only uses 5 per cent of the energy that we need to produce a new one. Rubbish is taken to places called recycling centers, where it is put into different groups. Later, each different kind of rubbish is broken into pieces and made into new materials. Recycling is easy to do, it is good for the natural world and it saves a lot of energy. Is there a recycling centre near you?

Saving energy means thinking more about the things that we do every day. If we do this, we can stop a lot of pollution, and save money too!

Vocabulary.

Clothes - things such as dresses or trousers that you wear to cover protect or decorate your body (платье, одежда).

Cool - to make something less hot (охлаждаться, освежаться).

Heat - to make something hot or warm, or the temperature of something (нагревать, накалять, горячить).

Imagine - to form or have a mental picture or idea of something (воображать, представлять себе).

Light bulb - the glass part of an electric lamp that gives light (лампочка).

Plastic - a light strong material used to make many different things (пластмасса).

Recycle - to do something to materials like paper and glass so that they can be used again (перерабатывать).

Rubbish - waste material or things that are no longer wanted or needed (мусор, хлам).

Turn off - (выключить).

Turn on - (включить).

Exercise 1. Answer the questions.

1. How much energy do people in Britain waste?
2. How many machines are on standby in your house?
3. Why is it necessary to use energy-saving light bulbs?
4. How do we use energy at home and is it better to use it?
5. Why rubbish can be dangerous?
6. How do people destroy their rubbish?
7. Explain the process of recycling rubbish.
8. Is there a recycling centre near you?
9. Is it a good idea to save energy? Why?

Exercise 2. Find the words of opposite meaning.

Turn on, save, turn off, spend, cool, heat, take off, long, put on, short, less, produce, more, destroy, safe, give, take, dangerous, break, make, difficult, new, old, easy, same, near, different, far, start, stop.

Exercise 3. Decide if the following statements are true or false.

1. Leaving a TV on standby all day is as watching it for an hour. T/F.
2. A normal light bulb uses only 10 per cent of the electricity. T/F.
3. The other 90 per cent is wasted. T/F.
4. Energy-saving light bulbs save 100 per cent of that electricity. T/F.
5. It also takes a lot of energy to heat water. T/F.
6. Around the world we produce millions of tons of rubbish every year. T/F.
7. All this rubbish is recycled. T/F.
8. Most of it is thrown into big holes in the ground. T/F.
9. Rubbish is taken to places called recycling centers. T/F.
10. Recycling is difficult to do. T/F.

11. Recycling is good for the natural world and it saves a lot of energy. T/F.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. She usually wears smart clothes.
2. Leave the cake to cool for an hour before cutting it.
3. A large house like this must be expensive to heat.
4. You can't imagine what a mess the house was in after the party.
5. Those flowers aren't real- they're made of plastic.
6. The Japanese recycle more than half their waste paper.
7. Put the empty box in the rubbish bin.

Read and translate the text.

The power of the atom

On a cold afternoon in December 1951, a small group of scientists stood in a room in Idaho, USA. They watched excitedly as four ordinary light bulbs were turned on, and then they shouted and shook hands. They had just invented a new way to make electricity: nuclear power.

Today, nuclear power produces about 13 per cent of the world's electricity. One kilogram of nuclear fuel can have as much energy as 1.5 million kilograms of coal! When nuclear power was invented, some people thought it was the answer to all our energy problems. Today, many people are afraid of it. So what is nuclear power, and what are the dangers?

Everything around us is made of atoms. Some metals like uranium are radioactive, which means that the centre of the atom can break. The process of breaking the centre of the atom is called nuclear fission, and it is this process that produces nuclear energy.

Uranium 235, the type of uranium that we usually use for fuel, is found in rocks around the world. It is difficult and expensive to get it from the rocks and make it into fuel. In nuclear power stations, sticks of uranium 235 fuel are put inside a place called a nuclear reactor. Other sticks called control rods go between the sticks of fuel. They stop the reactor from becoming too hot.

In most reactors, water is used to cool the fuel and the water then becomes hot. This hot water moves through pipes and heats 'clean' water outside the reactor. The clean water turns into steam that moves steam turbines.

Energy from nuclear fission travels through other things. This moving energy is called radiation, and it makes everything inside the reactor building radioactive. Radiation is very dangerous for people, so nuclear reactors have thick, strong walls. These stop water, gas or anything inside the reactor from escaping.

About thirty countries have nuclear power stations, and others want to build them. Many people think that using nuclear power is better than burning fossil fuels because it does not produce gases like CO_2. Other people worry about nuclear waste and accidents.

Nuclear safety: old fuel and other waste from nuclear reactors are very radioactive - and very dangerous. Some waste is recycled and used in reactors again, but a lot is kept in very strong containers under the ground. This worries many people. Could nuclear waste get into water in the ground one day? Could people steal nuclear waste and use it to make a bomb? Some nuclear waste will be dangerous for 20,000 years: that is a long time to keep something safe!

On 25 May 1986, nuclear fuel in a reactor at the Chernobyl power station in the Ukraine began to get hotter and hotter. Workers could not cool the reactor, and finally it exploded. Radioactive fuel and control rods were thrown high into the air. Fires in the reactor burnt for fifteen days, and radioactive smoke travelled across Europe and the Black Sea. By 2005 fifty-six people had died because of the accident. Scientists think that, in time, about 4,000 people in the Ukraine, Belarus and other countries may die because of Chernobyl.

Today, most nuclear power stations are much safer than they were at the time of Chernobyl, but things can still go wrong. On 11 March 2011, a huge earthquake happened under the sea near Japan. About forty minutes later, a wave 14 meters high hit the coast near the forty-year-old Fukushima nuclear power station. Water destroyed machines at the power station so people could not cool the reactors. In the days after the accident, teams of brave engineers worked day and night to keep the power station safe. There were big explosions, and radioactive gas went into the air. Later, radioactive water went into the sea. Much less radiation escaped from Fukushima than from Chernobyl, but it showed the world that safety in nuclear reactors is still terribly important.

Nuclear fusion: around the world, scientists are trying to build a new type of nuclear reactor. If they succeed, nuclear power will be much safer, and it will also become much more important. The new reactors will get energy from nuclear fusion.

Nuclear fusion happens on the sun, and it produces a lot more energy than nuclear fission. Inside the sun, atoms of hydrogen join together to make bigger helium atoms, and this produces a huge amount of energy. Future nuclear fusion reactors will not produce much waste, and they will also be safer because you can stop the fusion process quickly. So why are we not using them today?

Imagine trying to put the sun inside a room, and you will understand how difficult it is to build a fusion reactor. To start nuclear fusion, the atoms in the fuel must reach temperatures of about 150 million °C!

At the moment, people are trying different ways to start nuclear fusion and keep the hot fuel from touching the sides of the reactor, but it is very difficult. In the future, we may power our cities with nuclear fusion, but we have to find answers to a lot of problems first!

While nuclear fuels continue to provide power in many countries, scientists keep looking for new fuels that are clean and safe - and some of their ideas are quite unusual.

Vocabulary.

Atom - one of the very small things that everything is made of (атом).

Control rod - a rod of a neutron-absorbing substance used to vary the output power of a nuclear reactor.

Earthquake - a sudden strong shaking of the ground (землетрясение).

Helium - a gas that is lighter than air, will not burn, is an element and is used in balloons, airships and some types of lights (гелий).

Hydrogen - the lightest gas, with no color, taste or smell that combines with oxygen to form water (водород).

Invent - to design and/or create something which has never been made before (изобретать).

Nuclear fission - a nuclear reaction in which a heavy nucleus splits spontaneously or on impact with another particle, with the release of energy.

Nuclear fusion - a nuclear reaction in which atomic nuclei of low atomic number fuse to form a heavier nucleus with the release of energy.

Nuclear power - electric or motive power generated by a nuclear reactor (ядерная энергия).

Nuclear reactor - an apparatus or structure in which fissile material can be made to undergo a controlled, self-sustaining nuclear reaction with the consequent release of energy (атомный/ядерный реактор).

Ordinary - not different or special or unexpected in any way; usual (обычный, обыкновенный, простой, заурядный).

Radiation - powerful and dangerous rays that come from something radioactive (радиация, излучение).

Radioactive - having or producing the energy which comes from the breaking up of atoms (радиоактивный).

Rock - the dry solid part of the Earth’s surface, or any large piece of this which sticks up out of the ground or the sea (горная порода, валун, скала, утес).

Smoke - the grey, black or white mixture of gas and very small pieces of carbon that is produced when something burns (дым).

Stick - a long thin piece of something (палка).

Thick - having a large distance between two sides (толстый).

To be afraid of - feeling fear, or feeling worry about the possible results of a particular situation (бояться).

Wall - a vertical structure, often made of stone or brick that divides or surrounds something (стена).

Worry - to think about problems or unpleasant things that might happen in a way that makes you feel unhappy and feared (беспокоить, волновать).

Exercise 1. Answer the questions.

1. How and when was nuclear power invented?
2. So what is nuclear power, and what are the dangers?
3. How much electricity does nuclear power produce?
4. What metals are radioactive and what does it mean?
5. What is nuclear fission?

6. What type of uranium do we usually use for fuel?
7. Is it difficult and expensive to get it from the rocks? Why?
8. What stops the reactor from becoming too hot?
9. Explain the process of turning water into steam that moves steam turbines.
10. What is radiation? Is it dangerous?
11. Is it better using nuclear power than burning fossil fuels? Why?
12. Could nuclear waste get into water in the ground one day?
13. Could people steal nuclear waste and use it to make a bomb?
14. What happened at the Chernobyl power station?
15. What happened at Fukushima nuclear power station?
16. What is nuclear fusion?
17. So why are we not using nuclear fusion reactors today?
18. Do scientists keep looking for new fuels that are clean and safe?

Exercise 2. Find adjectives among the following list of words.

Excitedly, nuclear, energy, radioactive, stick, rod, difficult, thick, moving, produce, recycled, high, still, terribly, safe, unusual.

*Exercise 3.*Decide if the following statements are true or false.

1. A small group of scientists invented nuclear power in 1951. T/F.
2. Nuclear power produces about 13 per cent of the world's electricity. T/F.
3. Radioactive means that the centre of the atom can break. T/F.
4. Control rods stop the reactor from becoming too hot. T/F.
5. In most reactors, water is used to cool the fuel. T/F.
6. Nuclear reactors have thick, strong walls. T/F.
7. About ten countries have nuclear power stations. T/F.
8. Waste from nuclear reactors is kept in containers under the ground. T/F.
9. Today, most nuclear power stations are much safer. T/F.
10. The new reactors will get energy from nuclear fusion. T/F.
11. Future nuclear fusion reactors will not produce much waste. T/F.
12. In the future, we may power our cities with nuclear fusion. T/F.

Exercise 4. Rewrite these untrue sentences to make them true.

1. Nuclear fission happens when atoms join together.
2. Control rods help to heat the fuel inside the reactor.
3. The water inside a nuclear reactor changes into steam and turns turbines.
4. Most nuclear waste is recycled and used again.
5. An accident at Chernobyl destroyed machines in a nuclear power station.

Read and translate the text.

Super fuels

Imagine growing fuel on trees or getting it from rubbish. Imagine cars that run on air or produce water, not pollution! All around the world, people are making surprising new fuels.

Biogas. Biogas is made from plants or natural waste by living things called bacteria. They break the waste down and produce gases like methane and carbon monoxide. In most places, the gases pollute the air, but at Bandeirantes near Sao Paulo in Brazil, pipes take the gas from under the ground. The gas is burnt at a power station to produce electricity for 400,000 people!

Villagers in India use animal and food waste to make biogas. Bacteria break the waste down in a special container, and the gas is used for cooking and lights. Just 1 kilogram of waste produces enough biogas to make a light work for four hours. In Sweden, they even make biogas for cars from toilet waste! A year's waste from seventy toilets makes enough fuel for a small car to travel 16,000 kilometers.

Biofuels. Biofuels are made from fuels that grow. The oldest biofuel is wood, but today we are using different kinds of plants - and even old coffee! - To make new biofuels.

The problem with some biofuels is that it takes a lot of land to grow the fuel, which means less land for growing food. If you want to fly a Boeing 747 plane the 350 kilometers from London to Amsterdam on coconut biofuel, you will need to grow about 3 million coconuts! There is another problem too — people may destroy forests to grow plants for biofuel.

In Brazil, cars and buses have used a fuel called bioethanol for years. Bioethanol is great because we make it from the waste parts of plants that we already grow for food. Most Brazilian bioethanol is made from sugar cane, the tall plant that we grow for sugar. The sugar cane is broken up in machines, and the liquid is taken to make sugar. The rest of the plant is turned into paper or used to make bioethanol.

Even the electricity that the bioethanol factories use comes from burning sugar cane. Burning biofuels produces gases like CO_2, but when we grow them, the plants take CO_2 out of the air. Because of this, sugar cane bioethanol produces 78 per cent less CO_2 than petrol.

The newest biofuels are made from very small living things called algae. Algae produce more energy than other biofuels, and they can grow in places where we do not grow food, like seas and waste land.

In the future, people want to change the way that some bacteria and plants grow. In this way they hope to get biofuels that work better or grow in different places. One day there may be huge algae farms in the sea, and many buildings may grow biofuel plants on their roofs.

Driving on air! Electric cars do not burn fuel: devices called batteries keep electricity and use it to power the engine. People have driven them for years, and they are a great way to have less pollution in city centers, but where does the electricity come from? It may come from burning coal, for example.

Future electric cars will not need to get electricity from anywhere. People are developing new batteries which use metal called zinc. When zinc mixes with

oxygen from the air, a chemical process makes electricity. When the battery is finished, the zinc can easily be recycled and used again.

Hydrogen. The cleanest fuel is hydrogen. When hydrogen burns, it just makes water. We already have cars and even helicopters that use hydrogen, but this gas is difficult to produce. Today, most hydrogen is made from fossil fuels, and this produces pollution. About 4 per cent of hydrogen is made from water, but this process uses a lot of electricity and can be dangerous.

In 2010, engineers invented a machine which uses energy from the sun to make hydrogen. Other people are trying to use bacteria to make it. These 'clean' ways of making hydrogen are still very new. If they become cheaper, we may all drive hydrogen cars in the future.

Scientists are developing lots of new fuels, but it will be a long time before most of us can use them. The biggest problem is finding the money to make the necessary changes to things like cars and petrol stations. For example, there are about 140,000 petrol stations in the USA today, but only 2,800 of them sell bioethanol.

Renewable energy is energy which comes from things that go on and on, like the sun or the wind. Some of the fuels in this chapter are renewable, and some are not. Biofuels are renewable because we can grow them again every year. Hydrogen is a renewable fuel when we make it from water but not when we make it from fossil fuels.

Vocabulary.

Algae - very simple, usually small plants that grow in or near water and do not have ordinary leaves or roots (морская водоросль).

Bacteria - very small things that live in air, water, earth, plants, and animals (бактерия).

Biofuel - a fuel that is made from living things or their waste (биологическое топливо).

Biogas - a gas containing *methane* that can be burned as a fuel, produced by dead plants and animals as they decay (биологический газ).

Break down - If a machine or vehicle breaks down, it stops working (разломиться).

Coconut - a large brown hard fruit that grows on trees in hot countries (кокос, кокосовый орех).

Forest - a large area of land covered with trees and plants, usually larger than a wood, or the trees and plants themselves (лес).

Helicopter - a type of aircraft without wings that has one or two sets of large blades which go round very fast on top. It can land and take off vertically and can stay in one place in the air (вертолет).

Hydrogen - the lightest gas, with no color, taste or smell, that combines with oxygen to form water (водород).

Renewable - describes a form of energy that can be produced as quickly as it is used (возобновляемый).

Roof - the covering that forms the top of a building, vehicle, etc. (крыша, кровля).

Wind - a current of air moving approximately horizontally, especially one strong enough to be felt (ветер).

Zinc - a bluish white metal that is used in making other metals or for covering other metals to protect them (цинк).

Exercise 1. Answer the questions.

1. Are people making surprising new fuels all around the world?
2. What is biogas made from?
3. What are biofuels made from?
4. What is the problem with some biofuels?
5. What is bioethanol made from?
6. What are the newest biofuels made from?
7. Why will future electric cars not need to get electricity from anywhere?
8. What is the cleanest fuel?
9. What does hydrogen make, when it burns?
10. What is the biggest problem for scientists?
11. What is renewable energy?

Exercise2. Decide if the following statements are true or false.

1. In most places, the gases pollute the air. T/F.
2. Villagers in India use animal and food waste to make biogas. T/F.
3. The oldest biofuel is wood. T/F.
4. Algae produce more energy than other biofuels. T/F.
5. People hope to get biofuels that work better. T/F.
6. Electric cars burn fuel. T/F.
7. People are developing new batteries. T/F.
8. We already have cars and even helicopters that use hydrogen. T/F.
9. About 4 per cent of hydrogen is made from water. T/F.
10. Biofuels are renewable. T/F.
11. Hydrogen is not a renewable fuel. T/F.

Exercise 3. Complete the sentences with these words: biofuel, biogas, hydrogen, zinc.

1. _____ is very easy to recycle and use again.
2. It takes a lot of land to produce _____.
3. Bacteria help to make _____.
4. _____ is often made from fossil fuels.
5. People in India use _____ fuel for cooking and lights.
6. _____ makes electricity when it mixes with oxygen.

Exercise 4. Translate the following sentences using the key vocabulary above.

1. A substantial proportion on cars American cars could be biofuelled soon.

2. Our car broke down and we had to push it off the road.
3. The children got lost in the forest.
4. The injured were ferried to hospital by helicopter.
5. We should use renewable energy sources such as wind and wave power.
6. Put the luggage on the roof of the car.
7. There was a light wind blowing.

Read and translate the text.

A bright future

The sunlight that reaches earth in one hour has as much energy as all the power that people use in a year! But how can we get this energy and use it on earth?

'Solar' means 'coming from the sun', so when you use sunlight to make things hot, it is called solar thermal power. Many buildings use materials like glass and plastic to catch sunlight and heat the building. In Africa, people use solar cookers. When light hits the surface of the cooker, it is reflected into the middle. The middle becomes hot enough to heat water or cook food. In countries like Turkey and China, people put solar water heaters on their roofs. These are metal and glass boxes with water pipes in them. The glass catches heat and the metal reflects sunlight onto the water pipes, which carry the hot water down into the houses.

We can use sunlight to make electricity too, with devices called solar cells, which are made of silicon. When sunlight hits the silicon, particles inside it move, and this makes electricity. One solar cell does not produce much power, so we put the cells together to make big solar panels.

At the moment, the best solar cells can only use about 25 per cent of the sunlight that hits them, and they are an expensive way to produce electricity. But people are inventing better and cheaper solar cells all the time. In the future, we will use it to do more and more things. You can already buy solar lights, solar radios, and small solar panels for things like computers and phones.

We can use solar power to travel too. In July 2010, Andre Borschberg flew a solar plane called *Solar Impulse* for 26 hours before he stopped. Power for the four engines came from 12,000 solar cells on the wings of the plane. It was able to fly at night because of batteries inside the plane which kept solar energy. There are also solar boats, and every two years, in the World Solar Challenge, solar cars leave Darwin on a 3,000-kilometre journey across Australia. They all try to be the first to arrive in Adelaide, and the fastest cars can reach 100 kilometers per hour.

In sunny countries like Spain, China, and the USA, they are building huge solar power stations. Some use solar panels and others use devices called reflectors to reflect sunlight onto water pipes or tall towers. The Andasol power station in Spain is as big as seventy football fields. It produces enough energy for 200,000 homes!

Imagine standing in the Sahara Desert in fifty years' time. The bright sun hurts your eyes and the heat is fantastic. All around, you can see tall towers and thousands of solar reflectors. It is only a dream at the moment, but many people want to build hundreds of solar power stations in the Sahara Desert, where it is hot and sunny for 365 days a year. Just 0.3 per cent of the Sahara Desert gets enough sunlight to produce electricity for all the people in Europe!

Vocabulary.

Arrive - to reach a place, especially at the end of a journey; to happen or start to exist (прибывать, приходить, приезжать, наступать).

Boat - a small vehicle for travelling on water (лодка, судно).

Cheap - costing little money or less than is usual or expected (дешевый).

Cooker - a large box-shaped device which is used to cook and heat food either by putting the food inside or by putting it on the top (плита, печь).

Device - a tool or piece of equipment that you use for doing a special job (приспособление, прибор).

Desert - an area, often covered with sand or rocks, where there is very little rain and not many plants (пустыня).

Field - an area, usually covered with grass, used for playing sport (поле).

Glass - a hard transparent material which is used to make windows, bottles and other objects (стекло, стакан).

Invent - to make something that did not exist before (изобретать).

Middle - the central point, position or part (середина).

Pipe - a tube inside which liquid or gas flows from one place to another (труба).

Reflect - to throw back light from a surface (отражать).

Silicon - a grey element which is found combined with oxygen in a large number of common minerals, and which has unusual electrical characteristics (кремний).

Solar - coming from the sun (солнечный).

Solar cell - a device that changes light from the sun into electricity (элемент).

Solar panel - a lot of solar cells working together (солнечная батарея).

Sunlight - the light that comes from the sun (солнечный свет).

Surface - the outside or top layer of something (поверхность).

Thermal - connected with heat (восходящий поток теплого воздуха).

Thing - the exact fact, object, idea, event, etc. (вещь, предмет).

Exercise 1. Answer the questions.

1. How much energy does the sunlight that reaches earth in one hour have?
2. But how can we get this energy and use it on earth?
3. What is solar thermal power?
4. Name the ways how people use energy of the sun.
5. What material are solar cells made of?
6. Are there many cells in big solar panels?

7. Why don’t people use solar cells very often?
8. How do people use solar power?
9. Which countries have huge solar power stations?
10. What do people dream to build in the Sahara Desert?

Exercise 2. Decide if the following statements are true or false.
1. “Solar” means “coming from the sun”. T/F.
2. In Africa, people use solar cookers. T/F.
3. In Turkey and China, people put solar water heaters on their roofs. T/F.
4. We can use sunlight to make electricity too. T/F.
5. One solar cell produces much power. T/F.
6. People stopped inventing solar cells. T/F.
7. The Sahara Desert doesn’t get enough sunlight to produce electricity. T/F.

Exercise 3. Translate the following sentences using the key vocabulary above.
1. What time will your train arrive?
2. Are you travelling by boat or by air?
3. Food is usually cheaper in supermarkets.
4. They were lost in the desert for nine days.
5. It’s a huge window made from a single pane of glass.
6. He lives in a tiny cottage in the middle of nowhere.
7. He saw himself reflected in the water/mirror/shop window.
8. Solar panels are used to power satellites.
9. The lake sparkled in the bright sunlight.
10. The marble has a smooth, shiny surface.
11. What’s that thing over there?

Read and translate the text.

When the wind blows

On a clear day, you can see them from the land. They look like huge metal flowers growing out of the sea. When you get closer, you realize how big they are. The Thanet wind farm is 12 kilometers off the English coast. Each of its 100 wind turbines is 115 meters tall. As wind turns the turbines, generators inside them produce electricity. Together the turbines make enough power for 200,000 homes. There are 250 wind power stations, called wind farms, in Britain, and people are building more every year. By 2020, Britain may get 25 per cent of all its energy from the wind.

Bahrain is famous for the strong winds that blow at different times of the year. The World trade centre in Bahrain is a skyscraper with three wind turbines. The turbines are 29 meters across, and they produce about 15 per cent of the electricity for the building: that is enough energy for three hundred homes. The shape of the building moves the wind towards the turbines.

It was very difficult to build the Bahrain world trade centre because it was the first building of its type in the world. The engineers had to stop the moving turbines shaking the building and destroying it. Now, skyscrapers with huge wind turbines are appearing in cities around the world.

Some future skyscrapers will not use turbines: the building will turn in the wind. As the parts of the building move, generators between the floors will produce power. Because the wind will move faster at the top and slower at the bottom of the building, each floor will turn in a different way. What you can see from your window will change all the time!

Lots of city buildings now have small wind turbines on the roof, and you can even buy one to power your house. Wind turbines used to be ugly, but now there are lots of different shapes and colors and they are great for parks and city centers. Soon tourists will see a wind turbine with changing colors and pictures outside Buckingham Palace in London, for example.

Of course, wind turbines do not work when the wind is not blowing, but people are finding new ways to catch or produce enough wind. When it is not very windy on the ground, look at the sky, and you will often see the clouds moving fast above you. MARS wind turbines fly a few hundred meters above the ground. Their shape makes them turn in the wind, and that produces electricity. Long cables tie them to the ground and carry the electricity. Another idea is to use wind turbines next to busy roads. As cars go past, they move a lot of air, and this drives the turbines.

In Jinshawan, China, a tall tower stands in a field of glass. The sun heats the air under the glass. The hot air moves up the tower and wind turbines inside the tower make electricity. In the future, people are planning to build towers like this in places like Australia and the USA. Some of them will be higher than the tallest skyscrapers in the world!

We have used the wind to sail for thousands of years, but the engines of today's big ships use diesel fuel, which comes from oil. However, some new passenger ships have both engines and sails. The sails on these modern ships are moved by computers so they can move and catch the wind, saving the ship a lot of fuel. Skysails are another great idea because you can use them with any ship — even old ones. They fly about 200 meters above the ship and help to pull it through the water.

How about sailing to work in a car that uses the power of the wind? The Greenbird looks like a plane or a boat, but it moves on land. Sometimes it can reach 200 kilometers an hour! The Greenbird uses clever technology to move five times faster than the wind.

The Netherlands is a country of windmills - old buildings with sails that turn in the wind. The country's 1,200 windmills are hundreds of years old, and they are used for lots of things, like moving water and making machines work. Now, wind turbines that make electricity are appearing all over the Netherlands. For the people of the Netherlands, wind power is both the past and the future.

Vocabulary.

Cloud - a usually grey or white mass in the sky, made of very small floating drops of water (облако, туча).

Diesel - a type of heavy oil used as fuel (дизельное топливо).

Electricity - power that can make heat and light (электричество).

Floor - a level of a building (этаж).

Generator - a machine for producing electricity (генератор).

Power - strength; the supply of electricity; to supply energy or electricity to something (сила, мощь, энергия).

Power station - a building where electricity is produced (электростанция).

Road - a long hard surface built for vehicles to travel along (дорога).

Sail - a sheet of material fixed to a pole on a boat to catch the wind and make the boat move (парус).

Skyscraper - a very tall modern building, usually in a city (небоскреб).

Technology - using science to build and make new things (техника, технология).

Tower - a tall narrow building (башня).

Turbine - a machine that gets its power from a wheel that is turned by water or air (турбина).

Wind farm - a group of *wind turbines* (=tall structures with blades that are blown by the wind) that are used for producing electricity.

Windmill - a building or structure with large blades on the outside which, when turned by the force of the wind, provide the power for getting water out of the ground or crushing grain (ветряная мельница).

Exercise 1. Answer the questions.

1. How do wind turbines look like?
2. In what country do people use wind turbines?
3. In what country is there a skyscraper with three wind turbines?
4. Was that the first building of such a type?
5. Are there the same buildings around the world nowadays?
6. Will the future skyscrapers use turbines?
7. Do lots of city buildings now have small wind turbines on their roofs?
8. Do wind turbines work when the wind is not blowing?
9. What are the new ways to catch or produce enough wind?
10. Explain the work of a car that uses the power of the wind.

*Exercise 2.*Decide if the following statements are true or false.

1. The Thanet wind farm is 12 kilometers off the English coast. T/F.
2. Each of its 100 wind turbines is 115 meters tall. T/F.
3. Together the turbines make enough power for 200,000 homes. T/F.
4. There are 250 wind power stations, called wind farms, in Britain. T/F.
5. Bahrain is famous for the strong winds. T/F.
6. It was very difficult to build the Bahrain world trade centre. T/F.

7. Wind turbines used to be beautiful. T/F.
8. Soon tourists will see wind turbines with changing pictures. T/F.
9. MARS wind turbines fly a few hundred meters above the ground. T/F.
10. Wind turbines can be used next to busy roads. T/F.
11. Wind turbines that make electricity are used all over the Netherlands. T/F.

Exercise 3. Choose the best question-words for these questions, and then answer them: *how/how many/how much/what/where/which/who/why*.

1. … do solar cookers work?
2. … do we call lots of solar cells together?
3. … used solar energy to fly a plane?
4. … may we see lots of solar power stations one day?
5. … electricity does the Thanet wind farm produce?
6. … turbines are there at the Bahrain world trade centre?
7. … do people want to put wind turbines near roads?
8. … European country has used wind power for a long time?

Exercise 4. Translate the following sentences using the key vocabulary above.

1. Do you think those are rain clouds on the horizon?
2. My new car runs on (= uses) diesel.
3. The electricity has been turned off.
4. Take the elevator to the 51st floor.
5. Disconnect the power before attempting to repair electrical equipment.
6. We live on a busy/quiet road.
7. Modern technology is amazing, isn't it?

Read and translate the text.

Water world

I am standing by the Seyhan River, in Turkey, and watching fish swimming in the water. How many rivers like this are there in the world? Think of all that water running down towards the sea. Moving water has much more energy than the wind, and of course, it never stops.

What is hydroelectric power? A hydroelectric power station uses the power of water to produce electricity. The Itaipu Dam, between Brazil and Paraguay, is one of the largest hydroelectric power stations in the world. It took 40,000 workers nine years to build it, and engineers had to move the Parana River — one of the greatest rivers on earth. The Itaipu Dam is as tall as a skyscraper. Behind a dam, water is kept in a lake called a reservoir. Then, water from the reservoir moves down through huge pipes in the dam. The water turns turbines, which turn generators to produce electricity. The Itaipu Dam produces 90 per cent of Paraguay's electricity as well as enough power for 600 million people in Brazil!

Dams can be good in many ways. In Egypt, there used to be terrible floods on the River Nile after heavy rain, but the Aswan Dam has stopped the floods. Water stays behind the dam in Lake Nasser, and farms can use this water when it is dry. In Turkey, five dams on the Euphrates River have changed the land around them. Farmers can grow much more food, and people from the cities spend their weekends enjoying the beautiful lakes.

The biggest problem with dams is that their reservoirs cover a lot of land. Beautiful places and old buildings often disappear under the water, and people have to leave their homes. After engineers built the Itaipu Dam, people in boats worked hard to save animals as the water flooded the forest. They also moved thousands of trees and plants to higher places.

At Abu Simbel, in Egypt, people saved two 3,000-year-old Egyptian buildings from the waters of Lake Nasser. The huge buildings were cut into pieces, and then built again in a higher place. The workers had to cut a lot of stone by hand, and some of the stones were 30 tons!

You do not have to build a huge dam to get energy from rivers. A lot of people in Africa and Asia make hydroelectric power themselves. They put pipes and little turbines into rivers in places where the water is moving fast. This produces enough electricity for one or two houses, or sometimes a village. The smallest turbines only cost about 20 dollars: there are more than 100,000 of them in rivers in Vietnam. Of course, we do not have to get power only from rivers; 97 per cent of the world's water is in the sea. Now we are beginning to use it.

How to use power from the sea? In 2008, passengers in planes flying to Porto, Portugal, looked down and saw three strange shapes in the water a few kilometers from the beach at Aguçadoura. Each of these big red shapes was 142 meters long. In fact, this was the world's first wave farm, and the strange shapes were wave power generators. In the future, we may see many more farms like these near the Portuguese coast, getting power from the restless waves of the Atlantic.

When wave power generators go up and down on the water, liquids inside them move. The liquids turn turbines or push other devices to generate power. Long cables under the sea carry the electricity to the land. The great thing about wave power is that you can get electricity 24 hours a day. The problem is that the waves can be too big. Storms can destroy the machines or break the cables.

Getting power from the waves is still very difficult, but people are developing new devices all the time. In May 2010, a ship pulled a 200-metre wave power generator through Atlantic waters to Orkney, north of Scotland. In a few years, sixty-five more machines will join it, and together they will produce power for about 30,000 homes. Building and using the generators will mean new jobs for hundreds of people in Scotland.

Near New York City, six turbines sit at the bottom of the East River. They are 5 meters across and they look like wind turbines, but they get energy from sea water that moves past them twice a day. In places where rivers join the sea, the water can go up and down 10 meters or more, so it moves very fast and has a lot of energy. To use this energy, we can put turbines under the water or build dams. The world's

biggest dam that uses the power of the sea is at La Rance, in France. It is more than 300 meters long and its twenty-four turbines produce enough power for a city of more than 200,000 people.

Near the coast of Kona, Hawaii, the weather is sunny and the sea is very deep. The water is warm at the surface, but 1,000 meters below this it is 10-20 °C cooler. People use this temperature difference to make power. Power stations like the one at Keyhole Point in Hawaii use liquids like ammonia that become a gas at low temperatures. Warm sea water heats the liquids so they turn into gas. The gas moves turbines to generate electricity. Colder water from deeper under the sea turns the gas back into a liquid, so we can use it again.

Many countries already get a lot of their energy from water. For example, Norway gets 99 per cent of its electricity from hydroelectric power. We have used hydroelectric power for years, but in the future, people will get more energy from the sea too. We are still learning how to do this, but there are lots of possibilities. After all, 70 per cent of our planet is covered by water!

Vocabulary.

Coast - the land next to or close to the sea (морской берег, побережье).

Cut - to break the surface of something, or to divide or make something smaller, using a sharp tool, especially a knife (резать, разрезать, отрезать).

Dam - a wall that is built across a river to stop the water (дамба, плотина, запруда).

Destroy - to damage something so badly that it does not exist or cannot be used (разрушать, разбивать, уничтожать).

Difference - the way in which two or more things which you are comparing are not the same (отличие, различие, разница).

Disappear - If people or things disappear, they go somewhere where they cannot be seen or found (исчезать, исчезнуть, пропадать).

Dry - describes something that has no water or other liquid in, on, or around it (сухой, высохший).

Flood - when there is a flood, a lot of water covers the land (наводнение, половодье, разлив).

Hydroelectric - using the power of water to make electricity (гидроэлектрический).

Lake - a large area of water surrounded by land and not connected to the sea except by rivers or streams (озеро).

Land - the surface of the Earth that is not covered by water; an area of ground, especially when used for a particular purpose such as farming or building (земля, грунт, почва).

Plant - a living thing which grows in earth, in water or on other plants, and usually has a stem, leaves, roots and flowers and produces seeds (растение).

Possibility - a chance that something may happen or be true (возможность, вероятность).

Restless - unwilling or unable to stay still or to be quiet and calm, because you are worried or bored (беспокойный, непоседливый).

Reservoir - a place for storing liquid, especially a natural or artificial lake providing water for a city or other area (водохранилище, водоем).

Sea - the salty water which covers a large part of the surface of the Earth, or a large area of salty water, smaller than an *ocean*, which is partly or completely surrounded by land (море).

Shape - the particular physical form or appearance of something (форма, очертание).

Stone - the hard solid substance found in the ground which is often used for building, or a piece of this (камень).

Twice - two times (дважды, два раза).

Wave - a raised line of water that moves across the sea (волна, вал).

Exercise 1. Answer the questions.

1. What has more energy the wind or moving water?
2. What is hydroelectric power?
3. Can dams be good? How? Name all the ways.
4. What is the biggest problem with dams?
5. What building did people save at Abu Simbel, in Egypt?
6. How can people make hydroelectric power themselves?
7. How to use power from the sea?
8. What problem can happen with the waves?
9. Is it possible to use temperature difference to make power? Explain how.

Exercise 2. Decide if the following statements are true or false.

1. The Itaipu Dam is one of the largest hydroelectric power stations. T/F.
2. The Itaipu Dam is as tall as a skyscraper. T/F.
3. The Itaipu Dam produces 90 per cent of Paraguay's electricity. T/F.
4. You do not have to build a huge dam to get energy from rivers. T/F.
5. Wave power can produce electricity 24 hours a day. T/F.
6. Getting power from the waves is still very difficult. T/F.
7. In places where rivers join the sea water has a lot of energy. T/F.
8. Many countries already get a lot of their energy from water. T/F.
9. Norway gets 99 per cent of its electricity from hydroelectric power. T/F.
10. 100 per cent of our planet is covered by water. T/F.

Exercise 3. Match these halves of sentences.

1. The lake behind a dam …
2. Water moves through huge pipes in a dam …
3. Dams can help to stop…
4. People sometimes put small turbines into rivers…
5. We can get power from the waves with…
6. Wave power generators can…

7. Special liquids…
8. The water can go up and down 10 meters or more…

a) … flooding and keep water for when it is dry.
b) … be destroyed by bad weather.
c) … in places where rivers meet the sea.
d) … and turns turbines to make electricity.
e) … generators which go up and down on the water.
f) … are used to get heat energy from the sea.
g) … is called a reservoir.
h) … to make power for a few homes.

Exercise 4. Translate the following sentences using the key vocabulary above.
1. We spent a week by/on the coast (= by the sea).
2. Cut the meat up into small pieces.
3. It makes no difference where you put the aerial.
4. We looked for her but she had disappeared into the crowd.
5. These plants grow well in dry soil/a dry climate.
6. Japanese cars have flooded the market.
7. We used to go boating on that lake.
8. This sort of land is no good for growing potatoes.
9. The forecast said that there's a possibility of snow tonight.
10. He's a restless type- he never stays in one country for long.
11. We spent a lovely week by the sea this year.
12. Our table is oval in shape.
13. They cut enormous blocks of stone out of the hillside.
14. The state is at least twice as big as England.
15. At night, I listened to the sound of the waves breaking against the shore.

Read and translate the text.

Heat all around us

Imagine you are swimming outside in the beautiful blue waters of a hot pool near Reykjavik, Iceland. Snow is falling all around you, but the water is warm. After a relaxing swim, you catch a bus into the city, and then walk home through the streets. It is very cold, and the trees are heavy with snow, but there is no ice on the pavement. Why? That is all because under your feet, hot water is heating the streets.

Geothermal energy comes from heat under the ground, and people have used it for thousands of years. The Romans used geothermal water to heat bath houses. In New Zealand, Japan and Iceland, people enjoy swimming in geothermal pools.

Iceland has cold winters and short summers, but it is also a land where hot water and steam come up from under the ground. In some places, the steam is 250

°C! Iceland's five geothermal power stations use the steam from wells to drive turbines and produce about 25 per cent of the country's electricity. In other places, machines called pumps take hot water from the ground and send it through pipes to houses, and 87 per cent of the buildings in Iceland get their hot water and heating in this way. Hot water under the roads and pavements keeps them clear of snow and safe in the winter.

In places like Iceland, steam comes out of the ground naturally. In other places, pumps send cold water down through pipes to hot dry rocks hundreds of meters below. The rocks heat the water and make steam. A second pipe takes the steam from under the ground.

How safe is geothermal power? The answer is that it is not usually dangerous, but it can be. It is often difficult to drill geothermal wells. The steam can explode from the well, and it can bring dangerous gases with it too. Pumping cold water into the ground is not always safe either. In Basel, Switzerland, a geothermal power station which used cold water was closed after only six days, because in that time, there were 10,000 small earthquakes!

Today we only get geothermal energy from places where very hot rock lies close to the surface. However, the rocks become hotter as you go deeper everywhere on earth, because the centre of the earth is about 5,500 °C! The problem is that in most places you have to go down about 10 kilometers to find enough heat. Some oil wells are already this deep, but it is very expensive to drill them, so people do not do it yet for geothermal wells.

How hot is the ground under your feet? In most places around the world, if you dig down about 3 meters, the ground temperature is 10-16 °C all year. Devices called heat pumps use this heat to turn a special liquid into a gas. The gas moves through pipes next to water. As the gas loses heat energy and becomes a liquid again, it heats the water. In cold countries, hot water from heat pumps is used to heat buildings like schools, houses, and swimming pools.

When some materials become hot, particles inside them move, producing electricity. These are called thermoelectric materials. On a summer day, the streets of a city become very hot: a road can be 70 °C! In the future, some people want to put thermoelectric materials under the roads. This could change the heat into electricity for things like street lights.

Vocabulary.

Bathhouse - a building containing baths for communal use (купальня, баня).

Drill - a tool that you use for making holes (дрель, бур, бурав).

Earthquake - a sudden strong shaking of the ground (землетрясение).

Expensive - costing a lot of money (дорогой, дорогостоящий).

Explode - to (cause to) break up into pieces violently (взрывать, взорвать).

Geothermal - connected with natural heat that comes from under the ground.

Geothermal energy - relating to or produced by the internal heat of the earth.

Ground - the surface of the Earth; soil; an area of land used for a particular purpose or activity (земля, грунт, почва).

Heat pump - a machine that can move heat from one place to another ().

Liquid - water, oil, and milk are all liquids (жидкость, жидкий).

Naturally - happening or existing as part of nature and not made or done by people; as you would expect (естественно, конечно).

Particle - a part of an atom (частица, крупица).

Pavement - the part at the side of a road where people can walk (тротуар, мостовая).

Pipe - a tube inside which liquid or gas flows from one place to another (труба).

Safe - not in danger or likely to be harmed; not dangerous or likely to cause harm (безопасный, надежный).

Street light - a light illuminating a road typically mounted on a tall post (уличный фонарь).

Thermoelectric - producing electricity by a difference of temperatures.

Well - a deep hole in the ground where people get water or oil (колодец, нефтяная скважина, источник).

Exercise 1. Answer the questions.

1. Why can we swim in the waters of a hot pool near Reykjavik in winter?
2. How do people use geothermal water in different countries?
3. How do people use geothermal water in Iceland?
4. Does steam come out of the ground always naturally?
5. How safe is geothermal power?
6. What are the typical places for getting geothermal energy?
7. What is the ground temperature about 3 meters deep?
8. Explain the work of heat pumps.
9. What are thermoelectric materials?

Exercise 2. Decide if the following statements are true or false.

1. People have used geothermal energy for thousands of years. T/F.
2. The Romans used geothermal water to heat bath houses. T/F.
3. Hot water under the roads and pavements keeps them clear of snow. T/F.
4. It is often difficult to drill geothermal wells. T/F.
5. Pumping cold water into the ground is not always safe. T/F.
6. Heat pumps use this heat to turn a special liquid into a gas. T/F.
7. Today people put thermoelectric materials under the roads. T/F.

Exercise 3. Translate the following statements using the key vocabulary above.

1. They are going to drill for oil nearby.
2. Rolls Royce cars are very expensive.
3. He was driving so fast that his car tire exploded.
4. The ground was frozen hard and was impossible to dig.
5. Mercury is a liquid at room temperature.
6. Electrons are atomic particles.

7. She wished us a safe journey.

Read and translate the text.

People power

In 1988, a plane called *Daedalus* flew 115 kilometers between the Greek islands of Crete and Santorini. It is a very short flight for today's aero planes, but this plane did not have any engines. The power for the plane came from the pilot; he used his legs like someone riding a bicycle to make the plane go forward. In a time before modern machines, people used the power of their bodies to build the Great Wall of China. Today, people power is back.

In a small village in Malawi, Africa, children shout excitedly as they play on a merry-go-round. It is the favorite meeting place for all the village children. As they turn around and around, a pump uses their movement to bring water up from a well under the ground.

In Africa, getting clean water is a problem for many people. They may be many kilometers away from rivers, and river water is not always clean. Getting clean water from under the ground can be difficult, because pumps with engines are expensive to use and they often break. These merry-go-round 'play pumps' mean that villages and schools can have clean and safe drinking water - and the children can have fun too!

When you run, you have a lot of energy which comes from the movement of your body. When you suddenly stop, your body loses this energy. We already have watches and small medical devices which can use energy that we make when we move. In the future, people like police officers and soldiers may wear devices on their legs to 'catch' this lost energy and keep it in batteries. They could use the power for computers, radios or other devices.

In December 2008, most people walking across Hachiko Square, Tokyo, probably did not notice four yellow squares on the pavement as they hurried to work. The squares were made of special materials that make electricity when they change shape. When people stood on the squares, the shape of the materials changed and they produced electricity. The squares were only there for twenty days, but in that time they produced enough power to make a TV work for 1,400 hours! Imagine putting these squares under all the roads and pavements in Tokyo. One day, we may turn our streets into power stations!

Moving people can produce a lot of energy, but what about people who cannot move about - sick people or people sitting on trains? Even when we are resting, our bodies produce enough energy to power two laptops! Most of this energy is heat. Now people are developing medical devices which get their power by changing body heat into electricity. Soon doctors will use them to do things like getting information about their patients' blood, for example. This will be useful in places like Africa, where many villages do not have electricity.

We can use body heat in other ways too. Every day, 250,000 people use Stockholm's Central Station. They eat and drink, carry heavy bags, and run to catch trains - and their bodies produce a lot of heat when they do these things. Inside the station, heat pumps take heat from the air and use it to heat water for a nearby building. It is a great way to get free energy - all you need is a lot of people!

Vocabulary.

Battery - something that makes electricity for a clock, radio etc. (батарея, батарейка).

Bicycle - a two-wheeled vehicle that you sit on and move by turning the two *pedals* (= flat parts you press with your feet) (велосипед).

Carry - to transport or take something from one place to another (носить, нести, переносить).

Change - to make or become different, or to exchange one thing for another thing, especially of a similar type (менять).

Device - a tool or piece of equipment that you use for doing a special job (приспособление, прибор).

Engine - a machine that uses the energy from liquid fuel or steam to produce movement (двигатель, мотор).

Flight - a journey in an aircraft; an aircraft that is making a particular journey (полет, рейс).

Forward - towards the direction that is in front of you (вперед).

Free - costing nothing; not needing to be paid for (бесплатный).

Island - a piece of land completely surrounded by water (остров).

Laptop (computer) - a computer which is small enough to be carried around easily and is designed for use outside an office (портативный компьютер).

Lose - to no longer have something because you do not know where it is, or because it has been taken away from you (терять, утрачивать, лишаться).

Merry-go-round - (carousel) a large machine at a fair which turns round and has wooden or plastic animals or vehicles on which children ride (карусель).

Modern - designed and made using the most recent ideas and methods (современный).

Movement - when something moves from one place to another (движение).

Pilot - a person who flies an aircraft (летчик, пилот).

Plane - (aircraft) a vehicle designed for air travel, which has wings and one or more engines (самолет).

Power - strength; the supply of electricity; to supply energy or electricity to something (сила, мощь, энергия).

Pump - a machine that moves water, gas, or air (насос).

Shout - to speak with a very loud voice, often as loud as possible, usually when you want to make yourself heard in noisy situations, or when the person you are talking to is a long way away or cannot hear very well (выкрикивать, кричать).

Square - a flat shape with four sides of equal length and four angles of 90°; an area of approximately square-shaped land in a city or a town, often including the buildings that surround it (квадрат, площадь).

Soldier - a person who is in an army and wears its uniform, especially someone who fights when there is a war (солдат, боец).

Train - (vehicle) a railway engine connected to *carriages* for carrying people or wheeled containers for carrying goods (поезд).

Village - a group of houses and other buildings, such as a church, a school and some shops, which is smaller than a town, usually in the countryside (деревня, село).

Watch - (small clock) a small clock which is worn on a strap around the wrist or, sometimes, connected to a piece of clothing by a chain (часы).

Exercise 1. Answer the questions.

1. What was special about the flight of a plane called *Daedalus*?
2. What power did people use in a time before modern machines?
3. Is it an ordinary merry-go-round on which African children play?
4. What is the meaning of such merry-go-round 'play pumps'?
5. Do people make energy? Can we use it?
6. How do Japanese use the power people make?
7. How much power did the yellow squares produce for twenty days?
8. Is it possible that people who cannot move about produce energy?
9. How can we get their power?
10. In which countries will it be useful?
11. How do we get people power at Stockholm's Central Station?
12. Is it necessary that there will be more people?

Exercise2. Decide if the following statements are true or false.

1. *Daedalus* did not have any engines. T/F.
2. The power for the plane came from the pilot. T/F.
3. In Africa, getting clean water is a problem for many people. T/F.
4. Getting clean water from under the ground can be difficult in Africa. T/F.
5. There are watches and devices which use energy that we make. T/F.
6. People can wear such devices on their legs to 'catch' energy. T/F.
7. They could use the power for computers, radios or other devices. T/F.
8. Yellow squares were made of special materials that make electricity. T/F.
9. Moving people cannot produce a lot of energy. T/F.
10. If we are resting, we produce enough energy to power two laptops. T/F.
11. Most of this energy is heat. T/F.
12. Inside the Stockholm's Station heat pumps take heat from the air. T/F.

Exercise 3. Write the names of the places.

1. The pavements of this city are heated with hot water.
2. Swimming in geothermal pools is popular in these three countries.

3. There were a lot of earthquakes in this city after people drilled a well.
4. A man flew an unusual plane to this island.
5. In this country, children pump water when they play.
6. When people walked on yellow squares in this city, they made electricity.
7. A building in this city uses heat from people's bodies.

Exercise 4. Do you think these things will happen in the next 100 years? Write 1-5. (1 = definitely not, 2 = probably not, 3 = perhaps, 4 = probably, 5 = definitely).

1. Pollution will kill 30 per cent of all the world's animals.
2. New York and Shanghai will disappear under the sea.
3. Most of the electricity will be made in your street or your house.
4. The furniture in your bedroom will change shape when you want.
5. We will recycle 95 per cent of all our rubbish.
6. Factories will 'grow' many products like plants.
7. People will begin to live on the moon.

Exercise 5. Do you agree or disagree with these sentences? Why?

1. How does your country get most of its energy?
2. How can governments help people to use less energy?
3. Is it important to find ways to save energy?
4. Is it important to find new ways to produce energy?
5. Which forms of energy will people use the most fifty years from now?
6. How will new energy technologies change our lives?

Read and translate the text.

Nanopower

In 2005, scientists in the USA built a tiny car called the Nanocar. How small is it? It is difficult to imagine something so small, but a hair on your head is 20,000 times wider and millions of times longer! The wheels of the Nanocar were made from balls of carbon atoms. Scientists used heat to move the wheels and 'drive' the car.

Nanotechnology is building things from atoms or from molecules (which are atoms joined together, like H_2O). In the future, we will use it to make tiny machines called nanobots. Millions of these machines will do things like clean waste and build or fix things. Doctors may use them to help sick people: they could travel through our bodies and fix damage inside us.

Tiny generators called nanogenerators will produce power. They will get energy from light or from movements around them: for example, blood moving around your body or sound moving through the air. In the future, we may print nanogenerators onto materials for making clothes. They may power the phones in

our pockets, heat our clothes in cold weather, or change the colors of a favorite dress.

Scientists have already invented the first nanogenerators: tiny solar cells. Most solar cells only use the light that people can see. Nano solar cells can also use a different kind of light called infrared light; hot things produce this light all the time, even in the dark. We already use nano solar cells for making thin solar panels, but they are still very new. One day we may add them to liquids which we can put onto the outside of houses and cars. They will use the electricity that the nano solar cells produce.

While some people are making solar cells which are too small for us to see, other people want to put huge solar panels into space.

Vocabulary.

Atom - one of the very small things that everything is made of (атом).

Carbon atom - carbon atoms are able to link with each other and with other atoms to form chains and rings, and an infinite variety of carbon compounds exist.

Dark - with little or no light; nearer to black than white in color (темный).

Fix - to repair something; to fasten something in position so that it cannot move; to arrange or agree a time, place, price, etc. (укреплять, направлять, фиксировать).

Hair - the mass of thin thread-like structure on the head of a person, or any of these structures that grow out of the skin of a person or animal (волос, волосы).

Huge - very big (огромный, громадный, грандиозный).

Infrared - (of electromagnetic radiation) having a wavelength just greater than that of the red end of the visible light spectrum but less than that of microwaves. Infrared radiation has a wavelength from about 800 nm to 1 mm, and is emitted particularly by heated objects (инфракрасный).

Liquid - water, oil, and milk are all liquids (жидкость, жидкий).

Molecule - the simplest unit of a chemical substance, usually a group of two or more atoms (молекула).

Movement - when something moves from one place to another (движение).

Nano - very, very small, submicroscopic (from Greek *nanos* ‘dwarf’).

Nanobot - a very small machine that works by itself.

Nanogenerator - a very small machine that produces power.

Nanotechnology - a kind of technology that works with very small things (нанотехнология).

Produce - to make something as part of a process (производить, выпускать).

Solar cell - a device that changes light from the sun into electricity.

Technology - using science to build and make new things (технология).

Tiny - very small (крошечный).

Waste - to use more of something than is necessary or useful; things that are not wanted or needed (отбросы, мусор, отходы).

Wheel - a circular object connected at the centre to a bar, which is used for making vehicles or parts of machines move (колесо).

Exercise 1. Answer the questions.

1. How the car was called which was built in 2005?
2. How small was it?
3. What were the wheels of the Nanocar made of?
4. How was the car ‘driven’?
5. What is nanotechnology?
6. How will we use it in the future?
7. How will people use nanobots?
8. Name the possible sources of energy for nanogenerators.
9. Describe the first nanogenerators.
10. What kind of light can nano solar cells use?

Exercise 2. Guess the meaning of the following words.

1. A thick, black liquid that is made into petrol.
2. A wall across a river which stops the water.
3. When the ground shakes suddenly.
4. This makes electricity for a clock or radio.
5. Near to where you live.
6. To change materials like paper and glass and use them again.
7. The people who control a country.
8. A moving line of water.
9. A machine which makes electricity.
10. Part of an atom.

Exercise 3. Translate the following sentences using the key vocabulary above.

1. A molecule of CO_2 has one carbon atom and two oxygen atoms.
2. It was too dark to see properly.
3. He’s got short dark hair.
4. They live in a huge house.
5. They couldn’t fix my old computer, so I bought a new one.
6. Pilots are guided by an infrared optical system that shows images clearly.
7. She works for a company that produces electrical goods.
8. Modern technology is amazing, isn’t it?
9. He opposes any kind of nuclear waste being dumped at sea.
10. My suitcase is on wheels so that makes life a little easier.

Read and translate the text.

Energy in space

Imagine that the date is 2095. You live in a world without oil. Far above you, huge shapes are moving across the sky, but you cannot see them from the ground.

Like many places in the world, your city gets a lot of its energy from power stations in space. It does not sound possible, but it may happen one day.

We have used solar panels in space for years. For example, they power the satellites that move around Earth and send us information about the weather. Now some people want to send solar energy back to earth. How will they do this?

They plan to make huge solar panels from very light materials and pack them into small containers. When they are in space, they will open and join together to make solar power stations. Space solar power stations will take energy from the sun and send it back to Earth, where we will change it into electricity.

Gases and clouds stop a lot of solar energy before it reaches the Earth, but this is not a problem for solar panels in space. If they move around the planet, they can stay where the sun is and work 24 hours a day. A company in California plans to put the first panels into space in 2016. They will produce enough electricity for 250,000 homes.

When we send spacecraft to other planets, we often have to find unusual ways to power them. Some have engines which produce special atoms called ions to push them forward. Others use nuclear fuel. In 2010, a Japanese spacecraft called *Ikaros* began 'sailing' towards Venus. When particles from the sun hit its 'solar sails', they pushed the spacecraft forward, like the wind pushes the sails of a ship. Because of the success of *Ikaros*, other spacecraft may use solar sails in the future.

For more than ten years, scientists from around the world have lived and worked in space on the International Space Station. In the future, countries like China, Russia, and Japan plan to build places to live and work on the Moon. People will need to produce energy there because they cannot take enough fuel from Earth. They can use solar power in the day, but nights on the Moon are nearly two weeks long! How will they get energy to use in the dark?

At NASA, scientists have invented special batteries to use on the Moon. In the day, the batteries use solar energy to get hydrogen and oxygen from water. In the night, the battery mixes these gases so that they burn. This produces energy and leaves water, which the batteries can use again.

Since the Apollo 17 spacecraft left the Moon in December 1972, nobody has visited the Moon. One day, people will go back - and this time, with the help of new devices, they will probably stay.

Vocabulary.

Burn - to (cause something to) be hurt, damaged or destroyed by fire or extreme heat (жечь, сжигать, обжигаться).

Cloud - a usually grey or white mass in the sky, made of very small floating drops of water (облако, туча).

Container - a thing that you can put other things in, e.g. a box (сосуд, контейнер).

Earth - the world (земля).

Enough - as much as is necessary; in the amount or to the degree needed; as much as or more than is wanted (достаточное количество, довольно, достаточно).

Far - at, to or from a great distance in space or time (далеко).

Happen - (of a situation or an event) to have existence or come into existence (случаться, происходить, получаться).

Hit - to swing your hand or an object onto the surface of something so that it touches it, usually with force (ударять, бить, стукнуть).

Huge - very big (огромный, громадный, грандиозный).

Invent - to make something that did not exist before (изобретать).

Imagine - forming or having a mental picture or idea of something (воображать, представлять, предполагать, полагать).

Join - to connect or fasten things together (соединять, объединять, присоединять).

Leave (left, left) - to go away from someone or something, for a short time or permanently (оставлять, бросать, покидать).

Light - not heavy (легкий).

Moon - the round object which moves in the sky around the Earth and can be seen at night; a similar round object that moves around another planet (Луна, месяц).

Nearly - almost, or not completely (почти).

Oil - a thick liquid from under the ground that we use for energy (масло, нефть).

Pack - to put something into a bag, box, etc; to put a protective material around something before it is put into a bag, box, etc. so that it will not break or be damaged (упаковывать, укладывать, уложить).

Reach - to arrive at a place, especially after spending a long time or a lot of effort travelling; to stretch out your arm in order to get or touch something (дотягиваться, достигать, доставать).

Satellite - a device in space that moves around the earth and sends back information (спутник).

Solar - coming from the sun (солнечный).

Sound - to seem good, interesting, strange, etc. from what is said or written; to seem like something, from what is said or written (звучать, казаться).

Space - the place beyond earth where the moon and stars are (пространство, простор, космос).

Spacecraft - a vehicle that travels in space (космический корабль).

Stay - to not move away from or leave; to continue doing something, or to continue to be in a particular state (останавливаться, оставаться).

Weather - the conditions in the air above the Earth such as wind, rain or temperature, especially at a particular time over a particular area (погода).

Exercise 1. Answer the questions.

1. Will it be oil on Earth in the year 2095?

2. How will people get energy?
3. Will you be able to see huge shapes moving across the sky far above you?
4. How did people use solar panels in space for years?
5. Do people want to send solar energy back to Earth?
6. How will they do this?
7. Can solar panels stay where the sun is and work 24 hours a day?
8. When will be the first panels put into space?
9. How much electricity will they produce?
10. What are the unusual ways to power spacecrafts?
11. What was the success of *Ikaros*?
12. Where have scientists from around the world lived more than 10 years?
13. What are their plans for the future?
14. What will people do on the Moon?
15. Will they use solar power at night?
16. How long is a night on the Moon?
17. How will they get energy to use in the dark?
18. Will people go back to the Moon one day?

Exercise 2. Decide if the following statements are true or false.

1. We have used solar panels in space for years. T/F.
2. Solar panels power the satellites that move around Earth. T/F.
3. Solar panels send us information about the weather. T/F.
4. Now some people want to send solar energy back to earth. T/F.
5. Space stations take energy from the sun and send it back to Earth. T/F.
6. Gases and clouds stop a lot of solar energy before it reaches the Earth. T/F.
7. At NASA, scientists invented special batteries to use on the Moon. T/F.
8. Batteries use solar energy to get hydrogen and oxygen from water. T/F.
9. In the day, the battery mixes these gases so that they burn. T/F.
10. Since December 1972, nobody has visited the Moon. T/F.

Exercise 3. Fill in the gaps with these words: *atoms, infrared, nanogenerators, satellites, solar sails, space station, sun.*

1. The Nanocar was made from carbon _____.
2. _____ are very small machines which can produce power.
3. _____ is a kind of light that we cannot see.
4. _____ move around the Earth in space.
5. Solar panels can work all the time because they move to where the ____ is.
6. _____ use particles from the sun to push a spacecraft.
7. In space people live and work in a _____.

Read and translate the text.

Going local

We do not realize it, but we use space technology all the time. When we watch TV, the pictures may come from a satellite hundreds of kilometers above the earth. It is the same when we make phone calls or listen to the radio. Far above our heads, machines are working for us, but we will never see most of them.

A few hundred years ago, people mainly used the things they could see around them. Local people grew the food and made the products that people needed. For fuel, most people got wood from a nearby forest. Today, the things that we buy and the fuel that we use often get to us from the other side of the world. This wastes energy — and what happens when these things do not come?

Local power: in October 1973, governments argued, and countries in the Middle East stopped selling oil to Europe and the USA. Very soon, life started to change. In the USA, drivers waited for hours to buy petrol.

In Europe, people did not have enough fuel to heat their houses. The problems only lasted for five months, but companies closed and thousands of people lost their jobs. What did we learn from this? The short answer is probably ‘not very much’.

Most countries still get most of their energy from fossil fuels. This often comes in pipes or ships from thousands of kilometers away. In 2009, Russia and the Ukraine argued about the price of natural gas, so people stopped pumping it. In some places in Europe, people had no heating in the cold winter, and the temperature was down to -10 °C!

Slowly, different countries are starting to produce their own energy in different ways, so they need less fuel from other places. Brazil already produces a lot of biofuels, and Norway and Iceland get most of their power from hydroelectric and geothermal energy In the future, sunny Spain may get a lot of power from solar energy, and stormy island countries like Britain will use wind turbines and wave power generators.

Today we produce electricity in huge power stations and send it through cables to places far away. This wastes a lot of energy. Big power stations lose heat, and more energy is lost when the electricity travels through the power cables. Surprisingly, about 66 per cent of the energy from burning fossil fuels in power stations never reaches our homes.

Sometimes a group of power stations stop working or big power cables burn. When this happens, the lights of big cities may go out. Trains stop running and people sleep in their offices because they cannot go home. So what can we do about these problems? Is there a better way to make and send electricity? We may not find an answer to all these problems, but producing more power locally will help.

In the future, we may produce some of our electricity nearer to our homes. As new energy technologies become cheaper, we will use them in more and more places. People may get their electricity from a wind turbine in their street or a wave power generator at a local beach, and not from a big power station on the other side of the country.

Our houses will make more electricity too. Many will have solar panels or wind turbines on their roofs. We may also put tiny turbines in kitchen and bathroom

water pipes. Heat pumps in our walls may make hot water for the house, and perhaps the floors under our feet will make electricity when we walk on them. Each of these devices will only make a little power, but when we put them together, they will make a lot.

Making things locally, isn't that a good idea? Why is it better to buy books and music that go straight to a computer instead of onto paper or plastic? The answer is that it saves a lot of energy. It saves fuel and materials for making the products and their containers as well. In the future, some companies will save energy by making things in a different way.

Recently we have invented printers which print real objects from computer designs. Now they can even print objects with moving parts. Instead of making things like sports shoes and phones in factories and sending them to other countries, companies may sell designs for them. People will buy the designs and print the products at local 'object printing shops', or even at home.

Object printing will be great for small products, but what about making something big, like a car? In 2010, visitors to a car show in Los Angeles were shown a very different way to make cars. There were extraordinary designs for cars made from extra-light and extra-strong materials. The most surprising idea was the Maybach DRS: a future car which will make itself from living materials. It will grow like a plant!

If we can invent living materials, they will get energy from the sun in order to grow. Scientists will develop special ways to 'tell' these materials to grow into the parts of a car, or something else. Slowly the parts will appear, like fruit growing on a tree. Instead of sending heavy metal car parts in ships, companies will buy and sell the information that they need to grow the different parts.

When we throw away living materials, bacteria in the ground will break them down into pieces — they will not produce any rubbish or pollution. In the future, people may want to grow many different products, like chairs and houses. Living materials are still just an idea: we have not made them yet. But one day, our factories may turn into farms!

Imagine a world where products change when we want them to! It sounds like something from a Hollywood film, but a lot of people are studying this idea in universities around the world. They think that one day; millions of nanobots will join together and make themselves into objects at home. Each nanobot will be too small for our eyes to see. The objects will change when we want them to: computers will tell the nanobots to move and become a different shape. If this happens one day, we will not need to throw anything away. If there is an object that we do not need, we will make it into something else.

Imagine a desk which becomes a chair when you do not need to work, or a coat which gets longer when it rains. It sounds impossible, but some scientists believe that it will happen in fifty to a hundred years!

Exercise 1. Answer the questions.

1. Do we use space technology all the time?

2. Do people eat the same food as a few hundred years ago?
3. How do they get it? Is it dangerous for our planet?
4. What happened in October 1973?
5. How long did the problems last?
6. What happened as a result of that?
7. What was the decision of different countries?
8. How do we produce electricity nowadays?
9. Name all the disadvantages of it.
10. So what can we do about these problems?
11. Is there a better way to make and send electricity?
12. How will people produce electricity in the future?
13. Why is it better to buy books and music that go straight to a computer?
14. Explain the work of printers which print real objects.
15. How will people use such printers?
16. What is a very different way to make cars?
17. How can scientists invent living materials?
18. What are the advantages of living materials?
19. How factories may look one day?
20. How can products change when we want them to?
21. How much time do scientists need to make it possible?

Exercise 2. Decide if the following statements are true or false.

1. We use space technology all the time. T/F.
2. Most countries still get most of their energy from fossil fuels. T/F.
3. Different countries are starting to produce their own energy. T/F.
4. Today we produce electricity in huge power stations. T/F.
5. This wastes a lot of energy. T/F.
6. We may produce some of our electricity nearer to our homes. T/F.
7. People may get their electricity from a wind turbine in their street. T/F.
8. Our houses will make more electricity too. T/F.
9. We may also put tiny turbines in kitchen and bathroom water pipes. T/F.
10. Heat pumps in our walls may make hot water for the house. T/F.
11. Recently invented printers can print objects with moving parts. T/F.
12. People will buy the designs and print the products. T/F.
13. Object printing will be great for small products. T/F.
14. There were extraordinary designs for cars. T/F.
15. People want to grow many different products, like chairs and houses. T/F.
16. Living materials are still just an idea. T/F.
17. One day the objects will change when we want them to. T/F.
18. We will not need to throw anything away. T/F.
19. We will make it into something else. T/F.
20. It will happen in fifty to a hundred years. T/F.

Complete these two news stories with the following words: *electricity, fission, fuel, fusion, homes, million, panels, problems, reactor, reflect, safer, steam, sunlight, temperatures, turbines, waste.*

Solar power lights houses in Andalucia

A huge new solar power station has opened near Seville, in Spain. The 330-million-euro power station's 2,650 glass ____ catch ____ and ____ it onto a tower. Inside the tower, heat is used to turn water into ____, which turns ____ and produces enough ____ for 25,000 ____ in Andalucia.

MIT finds a way to catch the sun

Nuclear ____ happens naturally on the sun at ____ of about ten ____ degrees – too hot for any container on earth. Now scientists at MIT have discovered a way to keep the super-hot ____ used in nuclear fusion from touching the sides of the ____ and destroying it. Nuclear fusion is much ____ than nuclear ____, and it produces less radioactive ____. One day it could be the answer to all of our energy ____.

Read and translate the text.

Where next?

Today, about 7 billion people live on earth. In 2050, the population will be more than 9 billion. This means millions more cars, TVs, fridges, and computers - and many other machines that we have not invented yet. Where will we get the energy for all these things?

We have read about lots of ways to produce and save energy. Some ideas are very old. Others are quite new, and some of them look far into the future — to a time when objects can make themselves, and people are living in space.

Which energy technologies will we use most in the future? We do not know the answer to this question, but we do know that we cannot use fossil fuels. Ten years ago, people argued about the idea that pollution from fossil fuels was changing the world's climate. Today, scientists agree that it is - and they think it is happening very fast!

We are starting to build a future without fossil fuels. Turbines are appearing in rivers and on hills around the world, and people are starting to use new fuels. Every year, scientists are inventing new ways to make electricity from the things around us. We know a lot of ways to save energy, and some of us can even try to produce it ourselves. The big question is 'Can we change in time - before we destroy a lot of the natural world?' And what is the answer? We will have to wait and see.

Exercise 1. Decide if the following statements are true (T) or false (F), or not mentioned (N)?

1. Normal life becomes very difficult when there is no oil. T/F/N.
2. Russia sells most of its natural gas to Europe. T/F/N.
3. Much electricity is lost before it arrives at people's houses. T/F/N.
4. In the future, our houses may produce power. T/F/N.
5. Computers are inventing designs and printing objects from them. T/F/N.
6. In Los Angeles people have started growing cars. T/F/N.
7. Soon, India's population will be bigger than China's. T/F/N.
8. We are not sure that pollution is changing the weather. T/F/N.
9. Scientists found new ways to use fossil fuels to make electricity. T/F/N.

List of literature

1 Блинов Е. А. Автоматизация теплоэнергетических установок и систем теплоснабжения. – М., 2010.

2 Пакшин А. В. Источники и системы теплоснабжения предприятий. – М., 2014.

3 Паскарь Б. Л. Эксплуатация теплоэнергетических установок и систем. – М., 2004.

4 Ляшков В. И. Теоретические основы теплотехники. – М., 2009.

5 Khurmi R.S. Engineering thermodynamics. – Economic research service, U. S. department of heat power engineering, 2012.

6 Arthur M. Greene Heat engineering – Economic research service, U. S. department of heat power engineering, 2009.

7 Nag P.K. Heat engineering – Economic research service, U. S. department of heat power engineering, 2014.

8 Rajan T.V. Heat treatment: principles and techniques – New York, 2012.

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