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КАФЕДРА ИНОСТРАННЫХ ЯЗЫКОВ

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Английский язык
для аудиторных занятий студентов

направления подготовки 13.04.02 Электроэнергетика и электротехника

Учебное пособие

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Учебное пособие представляет собой курс профессионального английского языка, основной целью которого является развитие коммуникативных умений, овладение новыми языковыми средствами в соответствии с темами, сферами и ситуациями, связанными с будущей научной и профессиональной деятельностью; достижение практического владения языком, позволяющего использовать его в научной и профессиональной работе.

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Предисловие

Основной целью обучения студентов, обучающихся в магистратуре, является развитие коммуникативных умений, овладение новыми языковыми средствами в соответствии с темами, сферами и ситуациями, связанными с будущей научной и профессиональной деятельностью; достижение практического владения языком, позволяющего использовать его в научной и профессиональной работе.

Учебное пособие состоит из самостоятельных разделов. Цель каждого раздела - развитие умения чтения и адекватного перевода текстов по направлению подготовки и написания тезисов, докладов, рефератов и аннотаций.

В содержание учебного пособия включены оригинальные тексты по электротехнической и энергетической тематике, представляющие профессиональный интерес для студентов. После каждого раздела имеются лексические упражнения, которые направлены на обучение не только чтению различных видов (изучающего, ознакомительного, просмотрового и поискового), но и коммуникативным навыком.

Система лексических упражнений соответствует структуре занятия и способствует закреплению учебного материала.

Работа с данным пособием способствует формированию у обучающихся следующих компетенций:

УК- 4 - коммуникативные технологии, переводческие приёмы;

УК- 5 - способность анализировать и учитывать разнообразие культур в процессе межкультурного взаимодействия

ОПК-2 - способность применять современные методы исследования, оценивать и представлять результаты выполненной работы

I. POWER ENGINEERING

1. Read and translate the following text:

What is Engineering?

Engineering is the discipline, art, skill, profession, and technology of acquiring and applying scientific, mathematical, economic, social and practical knowledge, in order to design and build structures, machines, devices, systems, materials and processes.

The American Engineers' Council for Professional Development (ECPD) has defined ‘’engineering’’ as:

The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property.

Engineering has existed since ancient times as humans devised fundamental inventions such as the pulley, lever, and wheel. Each of these inventions is consistent with the modern definition of engineering, exploiting basic mechanical principles to develop useful tools and objects.

The term *engineering* itself has a much more recent etymology, deriving from the word *engineer*, which itself dates back to 1325, when an *engine’er* (literally, one who operates an *engine*) originally referred to “a constructor of military engines.”

Active vocabulary

tool	инструмент
engine	двигатель
cognizance	знание
pulley	шкив
lever	рычаг
to exist	существовать
to construct	построить
to operate	работать
to forecast	прогнозировать
to devise	разработать
to be consistent	быть последовательным
to derive	получить
creative	творческий
ancient	древний
useful	полезный
intended	предназначен
as respect to	по отношению к

Active vocabulary

Try to memorize the following words and phrases.

fossil fuel	ископаемое топливо
fuel wood	топливная древесина
global warming	глобальное потепление
biomass	биомасса
renewable source	возобновляемый источник
ozone depletion	разрушение озонового слоя
natural gas	природный газ
coal deposit	месторождение угля
consumption	потребление
dung cake	навоз
power	мощность
exploitation	эксплуатация
oil, crude oil	нефть
hydropower	гидроэлектроэнергия
capacity	мощность
solar energy	солнечная энергия
biodegradable waste	биоразлагаемые отходы
conversion	преобразование
emission	эмиссия, выброс
residue	остаток
fuel cell	топливный элемент
co-generation	когенерация
arrigation	ирригация
vehicular	автомобильный
ability	способность
to define	определить
to occur	происходить
to remain	остаться
to heat	нагревать
to harness	использовать
to generate	генерировать
to derive from	вывести из
to transform	преобразовывать
to exhaust	исчерпать
to reduce	уменьшать
to increase	увеличить
to combine	объединить

to power	обеспечивать энергией
relevant	уместный
conventional	обычный
geothermal	геотермальный
tidal	приливный
nuclear	ядерный
harmful	вредный
available	доступный
per capita	на душу населения
significantly	существенно
extremely	чрезвычайно, очень, крайне,
tremendously	чрезвычайно, невероятно

2. Do you know what forms of energy are of the greatest demand currently? Try to guess the energy sources percent of total energy consumed.

wind
biomass
coal
nuclear
oil
hydropower
other renewable
natural gas
ranium

3. Read the following international words and mind the stressed syllables.

electricity	transformation	geothermal
electrical	biomass	radioactive
nuclear	chemical	thermal
transform	hydropower	concentration
industrialization	potential	vibration
expertise	kinetic	compression
mechanical	gravitational	technology

4. Match the English and Russian equivalents.

a) biodegradable	1) ископаемое топливо
b) vehicular pollution	2) потреблять энергию
c) transverse waves	3) автотранспортные выбросы
d) fossil fuel	4) способствовать распространению

e) to cause emission	5) поперечные волны
f) ozone depletion	6) совместная выработка
g) co-generation	7) поддающийся разложению
h) to consume energy	8) истощение озонового слоя
i) civil engineering	9) в джоулях
j) in joules	10) гражданское строительство
k) to measure energy	11) британская тепловая единица
l) British thermal unit	12) измерять энергию

5. Decide whether the following statements are true or false according to the text.

1. The use of wind energy influenced the speed of moving.
2. Hydropower is a major source of energy in some countries.
3. Nuclear power has been used as an energy source for a century.
4. Vehicular pollution is considered to be a serious problem.
5. The discovery of fire by man was the first step to use energy.
6. The very first energy sources were renewable.
7. Industrial development and population growth results in increasing demand for energy.
8. The sun, wind, water are non-renewable sources.
9. Hydropower is energy derived from waves.
10. The use and generation of renewable energy sources have increased by more than 25 %

6. Complete the following sentences according to the text.

1) Work means … .
2) The consumption of non-renewable sources of energy causes … .
3) Energy is defined as …. .
4) Such sources as the sun and wind, can never be exhausted and therefore called 5) Renewable energy sources include … .
6) 15 % of the world's population in developed countries consume … .

7. Answer the following questions and give examples.

1) When did the use of energy in the form of fossil fuels begin growing? Why?
2) Why have alternative sources of energy become important and relevant in today's world?
3) What are non-conventional energy sources?
4) Why do we need energy?
5) When did people begin to use wind energy? Give the reason.
6) Where is geothermal energy derived from?

7) What method was used to generate a cleaner and less polluting form of energy?
8) What sources do we call non-renewable? Why?

8. What parts of the text can you define? Do they correspond to the paragraphs? Name each part.

1. _____ 4._____
2._____ 5._____
3._____ … _____

9. Write a summary of Text B.

The following text is in the jumbled order. Look at the plan of the text, read the paragraphs and number them in the correct order according to the plan.

Plan:

1) What does an engineer do?
2) Some examples of jobs that engineers do.
3) Environmental engineer.
4) Renewable energy engineer.
5) Sounds interesting, so how do I get into it?

10. Составьте к тексту вопросы и будьте готовы ответить на них. Обменяйтесь вопросами с партнёром.

Text C. Power engineering

Firstly, you need to consider whether you enjoy science and mathematics subjects, because many engineering and technology roles are based on science and mathematics principles. Depending on what kind of job you would like, you will probably need qualifications in these subjects. Qualifications in ICT and design and technology (D&T) are also extremely useful.

It may also be helpful to know that there are three nationally (and internationally) recognized professional levels that you can work towards. Each of these levels can be achieved by various routes of study - going to university to study an engineering course is just one of the many options available to you.

The word ‘’engineering’’ is likely to make you think of things like shipbuilding, ‘’engineering works’’ on the railway lines, or perhaps the mechanic that services or repairs your washing machine or car. In reality, engineering covers a far wider range of businesses and industries; not only building and transport structures, but also jobs in food, cosmetics, medicine and much more. Engineers work in all kinds of environments. There are still many jobs in traditional engineering sectors, but engineers are just as likely to work in offices, laboratories or studios, or outdoors, in the air and underground. Engineering today is closely

linked with technology and many engineering roles now rely heavily on technological devices and the most recent technological advances.

The quality of the land, air and water around us is becoming increasingly important with the onset of climate change. Engineers are on the forefront of preserving our planet and ensuring that modern technology is kind to the world in which we live. Being an environmental engineer might mean that you have a special interest in ecosystems and biology, or other branches of engineering like civil engineering (buildings, roads and structures). People who deal in public health matters may also be environmental engineers, helping to ensure that our world is preserved for humans as well as for plants and animals.

Engineers are concerned with the production of energy through natural resources such as the sourcing and use of wind, solar and wave power. They are involved in developing and maintaining power stations and the machinery used in alternative energy sourcing and production e.g. biofuel sourced from crops. Energy engineers construct equipment designed by engineering designers, and conduct testing and make modifications prior to installation and running. This involves extensive use of computer technology. They may work for industry, university or government research departments. They may hold senior positions, head up a team of energy engineers or have a key post in the team. Ultimately these engineers are focused on finding efficient, clean and innovative ways to supply energy to millions of households for years to come. Renewable energy is extremely important to the future of our planet and that's something that we'd all like to rely on.

Engineers influence every aspect of modern life and it's likely that today you will have already relied on the expertise of one or more engineers. Perhaps you've listened to an iPod? Or watched television? Did you wash your hair today? Do you use a bus on your way to the University? These have all been designed, developed and manufactured by engineers. Here are some examples of where engineers work to get you started (Большой иллюстрированный энциклопедический словарь, М., 2004).

Active vocabulary

Try to memorize the following words and phrases.

engineering	инженерные
range	диапазон
principle	принцип
environment	окружающая среда
option	вариант
technology	технология
branch	филиал

device	устройство
structure	структура
installation	установка
quality	качество
expertise	экспертиза
qualification	квалификация
modification	модификация
advance	продвижение
service	обслуживание
households	домохозяйства
equipment	оборудование
ecosystem	экосистема
research department	исследовательский отдел
forefront	передний край
to cover	покрыть
to design	проектировать
to maintain	поддерживать
to link with	ссылаться на
to ensure	обеспечить
to conduct	проводить
to influence	влиять
to consider	рассмотреть
to achieve	достичь
to rely on	полагаться на
to preserve	сохранить
to depend on	зависеть от
to construct	построить
to repair	восстановить
to recognize	признать
to involve	привлечь
to focus on	сосредоточиться на
to manufacture	производить
to be concerned with	иметь дело с
senior	старший
innovative	инновационный
extensive	обширный
ultimately	в конечном счёте
prior to	до

11. Answer the following questions and give examples.

1) What do energy engineers construct?
2) Is computer technology extensively used in the engineers' work? Give examples.
3) Where do engineers work?
4) Do engineers influence every aspect of life?
5) Environmental engineers have a special interest in ecosystems and biology, don't they? Why? Why not?
6) What are renewable energy engineers concerned with?
7) What are they involved in?
8) What are energy engineers focused on?
9) What principles are engineering and technology roles based on?
10) What are the three recognized professional levels?

12. Find key words and phrases which best express the general meaning of each paragraph.

13. Write a summary of Text C.

14. Match the technical fields with appropriate examples of products.

Technical field	**Products**
1) marine engineering	a) a road surface of a bridge
2) transport engineering	b) flat surface of a skateboard
3) building and construction	c) cement area around a swimming pool
4) civil engineering	d) computer game console
5) sports technology	e) flight deck
6) aerospace	f) a floor of a ship
7) electronics	g) a level of a bus
8) IT, entertainment industry	h) component of music system

15. What do you know about science and technology? Before you read the Text "The Role of Science and Technology in Our Life", discuss these questions with your group mates.

16. Read the text to find out if you are right or wrong.

The Role of Science and Technology in Our Life

To understand and explore the importance of science and technology in our daily lives, let us first start by defining the terms *science* and *technology*. Science covers the broad field of knowledge that deals with observed facts and the relationships among those facts. Technology refers to the use of tools, gadgets and resources that help us control and adapt to our environment. The term also refers to

the use of machines and utensils, which make our daily lives simpler and more organized.

The scientific revolution that began in the 16th century was the first time that science and technology began to work together. Today, science and technology are closely related. Many modern technologies such as space flights or nuclear power depend on science and the application of scientific knowledge and principles. In turn, technology provides science with up-to-date instruments for its investigation and research. Science provides the basis of much of modem technology.

Science and technology are part of almost every aspect of our lives. Although we rarely think about it, they make extraordinary mgs possible. At the flick of a switch, we have light and electricity, lien we are ill, science helps us get better. Science and technology create ways to improve our future.

Modern science and technology have changed our lives in many dramatic ways. Airplanes, automobiles, communications satellites, computers, plastics, and television are only a few of the scientific and technological inventions that have transformed human life. Research by nuclear physicists has led to the development of nuclear energy as a source of power. Agricultural scientists have developed better varieties of plants and highly effective fertilizers. The development of antibiotics and other new drugs has helped to control many infectious diseases. Now we live in the information era when the computer network embraces the globe and connects not only the countries and space stations but also many people all over the world. All these things prove the power and the greatest progressive role of science and technology in our life.

Although scientific and technological achievements have benefited us in many ways, they have also created serious problems. The rapid growth of industrial technology, for instance, has resulted in such grave effects as environmental pollution and fuel shortages. Breakthroughs in nuclear research have led to the development of weapons of mass destruction. Some people fear that biological research will produce new disease-causing bacteria or viruses that resist drugs. People are also concerned that computerized information systems may destroy personal privacy.

However, science itself is neither good nor bad. The uses that people choose to make of scientific knowledge determine whether that knowledge will help or harm society.

1. What do science and technology cover?
2. How are science and technology related?
3. Are science and technology part of every aspect of our lives?
4. How have science and technology changed our lives?
5. What are harmful effects of scientific and technological achievements?
6. What do the uses that people choose to make of scientific knowledge determine?

17. Read and translate the text:

Text A. Electricity (History)

The first machine for producing an electric charge was described in 1672 by the German physicist Otto von Guericke. It consisted of a sulfur sphere turned by a crank on which a charge was induced when the hand was held against it.

The French scientist Charles Fransois de Cisternay Du Fay was the first to make clear the two different types of electric charge: positive and negative.

Benjamin Franklin spent much time in electrical research. His famous kite experiment proved that the atmospheric electricity that causes the phenomena of lightning and thunder is identical with the electrostatic charge on a Leyden jar. Franklin developed a theory that electricity is a single "fluid" existing in all matter, and that its effects can be explained by excesses and shortages of this fluid.

The British chemist Joseph Priestley proved the law that the force between electric charges varies inversely with the square of the distance between the charges experimentally in 1766. Priestley also demonstrated that an electric charge distributes itself uniformly over the surface of a hollow metal sphere, and that no charge and no electric field of force exists within such a sphere.

Charles Augustin de Coulomb invented a torsion balance to measure accurately the force exerted by electrical charges. With this apparatus he confirmed Priestley's observations and showed that the force between two charges is also proportional to the product of the individual charges. Faraday, who made many contributions to the study of electricity in the early 19th century, was also responsible for the theory of electric lines of force.

The Italian physicists Luigi Galvani and Alessandro Volta conducted the first important experiments in electrical currents. Galvani produced muscle contraction in the legs of frogs by applying an electric current to them. Volta in 1800 announced the first artificial electrochemical source of potential difference, a form of electric battery.

The Danish scientist Hans Christian Oersted demonstrated the fact that a magnetic field exists around an electric current flow in 1819. In 1831 Faraday proved that a current flowing in a coil of wire could induce electromagnetically a current in a nearby coil. About 1840 James Prescott Joule and the German scientist Hermann Ludwig Ferdinand von Helmholtz demonstrated that electric circuits obey the law of the conservation of energy and that electricity is a form of energy.

An important contribution to the study of electricity in the 19th century was the work of the British mathematical physicist James Clerk Maxwell, who investigated the properties of electromagnetic waves and light and developed the theory that the two are identical. His work paved the way for the German physicist Heinrich Rudolf Hertz, who produced and detected electric waves in the atmosphere in 1886.

The Dutch physicist Hendrik Antoon Lorentz first advanced the electron theory, which is the basis of modern electrical theory in 1892. The widespread use of electricity as a source of power is largely due to the work of such pioneering American engineers and inventors as Thomas Alva Edison, Nikola Tesla, and Charles Proteus Steinmetz.

Words and expressions

electric charge	электрический заряд
sphere	шар
crank	заводная ручка, рычаг
to be induced	быть индуцированным
positive charge	положительный заряд
negative charge	отрицательный заряд
kite experiment	змейковый эксперимент
atmospheric electricity	атмосферное электричество
lightning	молния
thunder	гром
electrostatic charge	электростатический заряд
Leyden jar	лейденская банка
square of the distance	квадрат расстояния
to distribute	распределять
electrical current	электрический ток
magnetic field	магнитное поле
to induce	индуцировать
electromagnetic waves	электромагнитные волны
electron theory	теория электронов
widespread use	широкое использование
source of power	источник энергии
to vary inversely	изменяться обратно пропорционально

18. Ответьте на вопросы:

1. Who was the first physicist to describe the first machine for producing an electric charge?
2. What was the name of the first scientist who made clear the two different types of electric charge?
3. Who proved the identity of the atmospheric electricity with the electrostatic charge on a Leyden jar?
4. What is the British chemist Joseph Priesley is famous for?
5. Who was responsible for the theory of electric lines of force?

6. What kids of an experiment related to electric current did Italian physicists Luigi Galvani and Allesandro Volta conduct?

7. Does the magnetic field exist around the electric current?

8. Who proved the fact of the magnetic field's existence around the current?

9. Do electric circuits obey the law of the conservation of energy?

10. Who proved that the electricity is a form of energy?

11. What contributions to the study of electricity James Clerk Maxwell and Heidrik Rudolf Hertz did?

12. What are the names of American engineers and inventors who pioneered the widespread use of electricity as a source of power?

19. Найдите в тексте английские эквиваленты следующих слов и выражений:

электрический заряд; два различных типа; положительный; отрицательный; эксперимент; исследования в области электричества; атмосферное электричество; молния; электростатический заряд; избыток; недостаток; сила; квадрат расстояния; распределять; измерять; наблюдения; теория электрических линий; искусственный; электрохимический источник; электрические волны; теория электронов; основа современной электрической теории.

20. Закончите предложения подходящими по смыслу словосочетаниями:

1. The first machine for producing an electric Charge was described by …
   a) James Watt
   b) Alfred Nobel
   c) Otto von Guericke

2. There are two different types of electric charge …
   a) soft and hard
   b) negative and positive
   c) black and white

3. An electric charge distributes itself Uniformly over the surface of …
   a) hollow metal sphere
   b) flat piece of wood
   c) a Leyden jar

4. A magnetic field exists around …
   a) storage battery
   b) electric current flow
   c) the neighborhood

5. Electric circuits obey the law of …
   a) gravitation
   b) energy conservation
   c) Newton

6. The properties of electromagnetic waves
   a) controversial

and light are … b) negative

c) identical

7. The widespread use of electricity as a source of power is largely due to the work of … a) Albert Einstein
b) Thomas Edison
c) Nicola Tesla

21. Составьте предложения, используя данные слова и словосочетания:

1. Different; charge; types; positive; negative.
2. Electricity; atmospheric; lightning; thunder; phenomena; causes.
3. Electric; distributes; charge; itself; surface; over the; uniformly.
4. Conduct; experiments; current; electric.
5. Contributions; electricity; study; in 19th century.
6. Energy; electricity; form.
7. Modern; electrical theory; electron theory; basis.
8. Source; power; use; widespread; electricity.

22. ***Переведите на английский язык следующие предложения:***

1. Существуют два вида электрических зарядов: положительный и отрицательный.
2. Его эксперименты доказали, что атмосферное электричество, вызывающее феномен молнии и грома, идентично электростатическому заряду «лейденской банки».
3. Сила между электрическими зарядами изменяется обратно пропорционально квадрату расстояния между зарядами.
4. Этот учёный внёс большой вклад в развитие учения об электричестве.
5. Электричество является формой энергии.
6. Электрические цепи подчиняются законам сохранения энергии.
7. Свойства электромагнитных волн.
8. Широкое применение электричества как источника энергии произошло в начале прошлого века.

23. Read and annotate the text

Text B. What is energy?

Energy lights our cities, powers our vehicles, and runs machinery in factories. It warms and cools our homes, cooks our food, plays our music, and gives us pictures on television.

Energy is defined as the ability or the capacity to do work. We use energy to do work and make all movements. When we eat, our bodies transform the food into

energy to do work. When we run or walk or do some work, we 'burn' energy in our bodies. Cars, planes, trolleys, boats, and machinery also transform energy into work. Work means moving or lifting something, warming or lighting something. There are many sources of energy that help to run the various machines invented by man.

The discovery of fire by man led to the possibility of burning wood for cooking and heating thereby using energy. For several thousand years human energy demands were met only by renewable energy sources - sun, biomass (wood, leaves, twigs), hydel (water) and wind power.

As early as 4000-3500 BC, the first sailing ships and windmills were developed harnessing wind energy. With the use of hydropower through water mills or irrigation systems, things began to move faster. Fuel wood and dung cakes are even today a major source of energy in rural India. Solar energy is used for drying and heating.

With the advent of the Industrial Revolution, the use of energy in the form of fossil fuels began growing as more and more industries were set up. This occurred in stages, from the exploitation of coal deposits to the exploitation of oil and natural gas fields. It has been only half a century since nuclear power began being used as an energy source.

In the past century, it became evident that the consumption of non-renewable sources of energy had caused more environmental damage than any other human activity. Electricity generated from fossil fuels such as coal and crude oil has led to high concentrations of harmful gases in the atmosphere. This has in turn led to problems such as ozone depletion and global warming. Vehicular pollution is also a grave problem.

There has been an enormous increase in the demand for energy since the middle of the last century as a result of industrial development and population growth. World population grew 3,2 times between 1850 and 1970, per capita use of industrial energy increased about twenty fold, and total world use of industrial and traditional energy forms combined increased more than twelvefold.

Due to the problems associated with the use of fossil fuels, alternative sources of energy have become important and relevant in today's world. These sources, such as the sun and wind, can never he exhausted and are therefore called renewable. Also known as the non-conventional sources of energy, they cause less emission and are available locally. Their use can significantly reduce chemical, radioactive, and thermal pollution. They are viable sources of clean and limitless energy. Most of the renewable sources of energy are fairly non-polluting and considered clean. However, biomass is a major polluter indoors.

Renewable energy sources include the sun, wind, water, agricultural residue, fuel wood, and animal dung. Fossil fuels are non-renewable sources. Energy

generated from the sun is known as solar energy. Hydel is the energy derived from water. Biomass – firewood, animal dung, and biodegradable waste from cities and crop residues – is a source of energy when it is burnt. Geothermal energy is derived from hot dry rocks, magma, hot water springs, natural geysers, etc. Ocean thermal is energy derived from waves and also from tidal waves.

Through the method of co-generation a cleaner and less polluting form of energy is being generated. Fuel cells are also being used as cleaner energy source.

Total commercial energy consumption has been growing tremendously since the last decade. Per capita commercial energy consumption in low-income countries have more than doubled. About 15 % of the world's population living in the wealthy industrialized nations consume over half the energy used in the world. The number of motor vehicles in use worldwide has more than doubled since 1970.

In some respects, the global energy system has evolved in a cleaner direction in the last 25 years. The share of world primary energy derived from natural gas the cleanest fossil fuel - has increased by more than 25 %. So has the use and generation of renewable energy sources.

Still the overall efficiency of energy production remains extremely low: on average, more than 90 % of energy consumed is lost or wasted in the process of conversion from raw materials such as coal to the final energy service such as the light to read a book. The main problem isn't that we use energy, but how we produce and consume energy resources. What we really need are energy sources that will last forever and can be used without polluting the environment. Conserving energy has become the need of the day be it in the transport, household, or industrial sectors.

Active vocabulary

Try to memorize the following words and phrases.

fossil fuel	ископаемое топливо
fuel wood	топливная древесина
global warming	глобальное потепление
biomass	биомасса
renewable source	возобновляемый источник
ozone depletion	разрушение озонового слоя
natural gas	природный газ
coal deposit	месторождение угля
consumption	потребление
dung cake	навоз

power	мощность
exploitation	эксплуатация
oil, crude oil	нефть
hydropower	гидроэлектроэнергия
capacity	мощность
solar energy	солнечная энергия
biodegradable waste	биоразлагаемые отходы
conversion	преобразование
emission	эмиссия, выброс
residue	остаток
fuel cell	топливный элемент
co-generation	когенерация
arrigation	ирригация
vehicular	автомобильный
ability	способность
to define	определить
to occur	происходить
to remain	остаться
to heat	нагревать
to harness	использовать
to generate	генерировать
to derive from	вывести из
to transform	преобразовывать
to exhaust	исчерпать
to reduce	уменьшать
to increase	увеличить
to combine	объединить
to power	обеспечивать энергией
relevant	уместный
conventional	обычный
geothermal	геотермальный
tidal	приливный
nuclear	ядерный
harmful	вредный
available	доступный
per capita	на душу населения
significantly	существенно
extremely	чрезвычайно, очень, крайне, чрезвычайно,
tremendously	невероятно

Comprehension check

24. Do you know what forms of energy are of the greatest demand currently? Try to guess the energy sources percent of total energy consumed.

1) wind
2) biomass
3) coal
4) nuclear
5) oil
6) hydropower
7) other renewable
8) natural gas
9) uranium

25. Read the following international words and mind the stressed syllables.

electricity	transformation	geothermal
electrical	biomass	radioactive
nuclear	chemical	thermal
transform	hydropower	concentration
industrialization	potential	vibration
expertise	kinetic	compression
mechanical	gravitational	technology

26. Match the English and Russian equivalents.

a) biodegradable	1) ископаемое топливо
b) vehicular pollution	2) потреблять энергию
c) transverse waves	3) автотранспортные выбросы
d) fossil fuel	4) способствовать распространению
e) to cause emission	5) поперечные волны
f) ozone depletion	6) совместная выработка
g) co-generation	7) поддающийся разложению
h) to consume energy	8) истощение озонового слоя
i) civil engineering	9) в джоулях
j) in joules	10) гражданское строительство
k) to measure energy	11) британская тепловая единица
l) British thermal unit	12) измерять энергию

27. Decide whether the following statements are true or false according to the text.

1) The use of wind energy influenced the speed of moving.

2) Hydropower is a major source of energy in some countries.
3) Nuclear power has been used as an energy source for a century.
4) Vehicular pollution is considered to be a serious problem.
5) The discovery of fire by man was the first step to use energy.
6) The very first energy sources were renewable.Industrial development and population growth results in increasing demand for energy.
7) The sun, wind, water are non-renewable sources.
8) Hydropower is energy derived from waves.
9) The use and generation of renewable energy sources have increased by more than 25 %

28. Complete the following sentences according to the text.

1) Work means … .
2) The consumption of non-renewable sources of energy causes … .
3) Energy is defined as …. .
4) Such sources as the sun and wind, can never be exhausted and therefore called
5) Renewable energy sources include … .
6) 15 % of the world's population in developed countries consume … .

29. Answer the following questions and give examples.

1) When did the use of energy in the form of fossil fuels begin growing? Why?
2) Why have alternative sources of energy become important and relevant in today's world?
3) What are non-conventional energy sources?
4) Why do we need energy?
5) When did people begin to use wind energy? Give the reason.
6) Where is geothermal energy derived from?
7) What method was used to generate a cleaner and less polluting form of energy?
8) What sources do we call non-renewable? Why?

30. What parts of the text can you define? Do they correspond to the paragraphs? Name each part.

1. _____ 4._____
2._____ 5._____
3._____ 6._____

31. Write a summary of Text B.

The following text is in the jumbled order. Look at the plan of the text, read the paragraphs and number them in the correct order according to the plan.

Plan:

1) What does an engineer do?
2) Some examples of jobs that engineers do.
3) Environmental engineer.
4) Renewable energy engineer.
5) Sounds interesting, so how do I get into it?

32. Read and annotate the text

Text D. Forms of energy

Energy is found in different forms including light, heat, chemical, and motion. There are many forms of energy, but they can all be put into two categories: potential and kinetic.

Kinetic energy is motion – of waves, molecules, substances, and objects. Forms of kinetic energy include:

Radiant Energy is electromagnetic energy that travels in transverse waves. Radiant energy includes visible light, x-rays, gamma rays and radio waves. Light is one type of radiant energy. Sunshine is radiant energy, which provides the fuel and warmth that make life on the Earth possible.

Thermal Energy, or heat, is the vibration and movement of the atoms and molecules within substances. As an object is heated up, its atoms and molecules move and collide faster. Geothermal energy is the thermal energy in the Earth.

Motion Energy is energy stored in the movement of objects. The faster they move, the more energy is stored. It takes energy to get an object moving and energy is released when an object slows down. Wind is an example of motion energy. A dramatic example of motion is a car crash, when the car comes to a total stop and releases all its motion energy at once in an uncontrolled instant.

Sound is the movement of energy through substances in longitudinal (compression/rarefaction) waves. Sound is produced when a force causes an object or substance to vibrate – the energy is transferred through the substance in a wave. Typically, the energy in sound is far less than other forms of energy.

Potential energy is stored energy and the energy of position – gravitational energy. There are several forms of potential energy:

Chemical Energy is energy stored in the bonds of atoms and molecules. Biomass, petroleum, natural gas, and coal are examples of stored chemical energy.

Chemical energy is converted to thermal energy when we burn wood in a fireplace or burn gasoline in a car's engine.

Mechanical Energy is energy stored in objects by tension. Compressed springs and stretched rubber bands are examples of stored mechanical energy.

Nuclear Energy is energy stored in the nucleus of an atom - the energy that holds the nucleus together. Very large amounts of energy can be released when the nuclei are combined or split apart. Nuclear power plants split the nuclei of uranium atoms in a process called fission. The sun combines the nuclei of hydrogen atoms in a process called fusion.

Gravitational Energy is energy stored in an object's height. The higher and heavier the object, the more gravitational energy is stored. When you ride a bicycle down a steep hill and pick up speed, the gravitational energy is being converted to motion energy. Hydropower is another example of gravitational energy, where the dam ‘’piles’’ up water from a river into a reservoir.

Electrical Energy is what is stored in a battery, and can be used to power a cell phone or start a car. Electrical energy is delivered by tiny charged particles called electrons, typically moving through a wire. Lightning is an example of electrical energy in nature, so powerful that it is not confined to a wire.

Active vocabulary

Try to memorize the following words and phrases.

to compress	сжимать
to store	хранить
to convert	преобразовывать
to include	включить
to collide	сталкиваться
to transfer	передавать
to split	разделить
to release	освободить
to charge	зарядить
stretched	растянутый
transverse	поперечный
dramatic	резкий, драматический
tiny	крошечный
longitudinal	продольный
radiant	лучистый

33. Complete the following sentences according to the text.

1) Sunshine provides ...

2) Geothermal energy is ...
3) The faster objects move, the more energy is ...
4) Energy is found in different forms including ...
5) All forms of energy can be put into two categories: ... and...
6) Kinetic energy is ...
7) ... are forms of kinetic energy.
8) The energy in sound is far less than ...
9) Potential energy is stored energy and ...
10) Forms of potential energy include ...
11) Chemical energy is converted to thermal energy when we ...
12) Nuclear power plants split the nuclei of uranium atoms in a process called ...
13) But the sun combines the nuclei of hydrogen atoms in a process called ...
14) The ... the object, the more gravitational energy is stored.
15) Electrical energy is delivered by ... called electrons.

34. Answer the following questions and give examples.

1) What are the main categories of energy?
2) What is potential energy?
3) What is kinetic energy?
4) When is chemical energy converted to thermal energy?
5) Mission and fusion are synonyms, aren't they? Why? Why not?
6) What physical process happens when you ride a bicycle?
7) What is named ‘’an electron’’?
8) What makes life on the Earth possible?
9) As an object is heated up, its atoms and molecules move and collide slower, don't they? Why? Why not?
10) What is the least form of energy?

35. Fill in the table using the information from Text D.

Energy categories	**Forms energy**	**Definitions**	**Examples**
kinetic energy	radiant energy	…	visible light, x-rays, gamma rays, radio waves
	thermal energy	…	…
	…	is stored in the movement of objects	…
	…	…	…

	chemical energy	…	biomass, coal, petroleum, natural gas
	…	is stored in objects by	…
	…	…	…
	…	…	hydropower, ...
	electrical	…	…

36. Choose the best abstract for Text D.

a) The text under consideration is about energy. It dwells on the usage and examples of different energy forms in nature.

b) The text deals with two categories of energy such as potential and kinetic. The author gives the definitions of various forms of energy and points out their examples.

c) The examples of several energy forms are commented in the text. The author also touches upon the difference between kinetic and potential energies.

37. Find key words and phrases which best express the general meaning of each paragraph.

38. Write a summary of Text D.

39. Discuss with your groupmates or in pairs the examples of potential and kinetic forms of energy from every day life.

40. Read the texts of unit 1 again and make the notes under the following headings. Then use your notes to talk about Energy and Energy Engineering.

1. The definition of energy.
2. Sources of energy.
3. Potential and kinetic energies.
4. The work of an energy engineer.

41. Read and translate the text:

Current Electricity

If two equally and oppositely charged bodies are connected by a metallic conductor such as a wire, the charges neutralize each other. This neutralization is accomplished by means of a flow of electrons through the conductor from the

negatively charged body to the positively charged one. (In some branches of electrical engineering, electric current has been conventionally assumed to flow in the opposite direction, that is, from positive to negative.) In any continuous system of conductors, electrons will flow from the point of lowest potential to the point of highest potential. A system of this kind is called an electric current. The current flowing in a circuit is described as direct current (DC) if it flows continuously in one direction, and as alternating current (AC) if it flows alternately in either direction.

Three interdependent quantities determine the flow of direct currents. The first is the potential difference in the circuit, which is sometimes called the electromotive force (emf) or voltage. The second is the rate of current flow. This quantity is usually given in terms of the ampere, which corresponds to a flow of about 6 250 000 000 000 000 000 electrons per sec past any point of the circuit. The third quantity is the resistance of the circuit. Under ordinary conditions all substances, conductors as well as nonconductors, offer some opposition to the flow of an electric current, and this resistance necessarily limits the current. The unit used for expressing the quantity of resistance is the ohm (V), which is defined as the amount of resistance that will limit the flow of current to 1 amp, in a circuit with a potential difference of 1 V. This relationship is known as Ohm's law and is named after the German physicist George Simon Ohm, who discovered the law in 1827. Ohm's law may be stated in the form of the algebraic equation E = I x R, in which E is the electromotive force in volts, I is the current in amperes, and R is the resistance in ohms. From this equation any of the three quantities for a given circuit can be calculated if the other two quantities are known. Another formulation of Ohm's law is I = E/R.

When an electric current flows through a wire, two important effects can be observed: the temperature of the wire is raised, and a magnet or a compass needle placed near the wire will be deflected, tending to point in a direction perpendicular to the wire. As the current flows, the electrons making up the current collide with the atoms of the conductor and give up energy, which appears in the form of heat. The amount of energy expended in an electric circuit is expressed in terms of the joule.

Words and expressions

equal	равный
charged bodies	заряженные частицы
metallic conductor	металлический проводник
neutralize	нейтрализовать
flow of electrons	поток электронов
conductor	проводник
negatively charged	негативно заряженный
electron	электрон

positively charged	положительно заряженный
electrical engineering	электротехника
electric current	электрический ток
direct current (DC)	постоянный ток
alternating current (AC)	переменный ток
electromotive force (emf)	электродвижущая сила
resistance	сопротивление
conductor	проводник
quantity of resistance	размер сопротивления
algebraic equation	алгебраическое уравнение
compass needle	стрелка компаса

42. Составьте предложения, используя данные слова и словосочетания:

1. Metallic conductor; connected; neutralize; charged; bodies.
2. Electrical; engineering; current; electrical; opposite; positive; negative.
3. Flow; second; rate; current.
4. Limits; resistance; current; necessarily.
5. Law; can be stated; equation; Ohm's.
6. Collide; atoms; electrons; conductor; energy.
7. Joule; energy; amount; expended; circuit; electric.
8. Needle; compass; placed; deflected; magnet.

43. Переведите на английский язык следующие предложения:

Равные и противоположено заряженные тела соединены между собой металлическим проводником.

1. Поток электронов от отрицательно заряженного тела к положительно заряженному телу.
2. Поток электронов от точки с низшим потенциалом к точке с высшим потенциалом.
3. Сопротивление в сети ограничивает величину тока.
4. Закон Ома можно выразить в виде следующего алгебраического уравнения.
5. При прохождении электрического тока по проводу, температура провода повышается.
6. При столкновении электронов тока с атомами проводника образуется энергия.
7. Стрелка компаса, расположенного рядом с проводом будет отклоняться в направлении перпендикулярном проводу.

44. Read and annotate the text

Electric power systems

The production and transmission of energy in the form of electricity have important economic advantages in terms of cost per unit of power delivered. Electric power systems also make possible the utilization of hydroelectric power at a distance from the source. Alternating current (AC) is generally used in modern power systems, because it may be easily converted to higher or lower voltages by means of transformers. Thus, each stage of the system can be operated at an appropriate voltage. Such an electric power system consists of six main elements: the power station; a set of transformers to raise the generated power to the high voltages used on the transmission lines; the transmission lines; the substations at which the power is stepped down to the voltage on the sub transmission lines; the sub transmission lines; and the transformers that lower the sub transmission voltage to the level used by the consumer's equipment.

In a typical system the generators at the central station deliver a voltage of from 1000 to 26,000 volts (V); higher voltages are undesirable because of difficulties of insulation and the danger of electrical breakdown and damage. This voltage is stepped up by means of transformers to values ranging from 138,000 to 765,000 V for the primary transmission line. At the substation the voltage may be transformed down to levels of 69,000 to 138,000 V for further transfer on the sub transmission system. Transformers step down the voltage again to a distribution level. Finally the voltage is transformed once again at the distribution transformer near the point of use to 240 or 120 V.

The central station of a power system consists of a prime mover, such as a water or steam turbine, which operates an electric generator. Most of the world's electric power in the early 1990s was generated in steam plants driven by coal, oil, nuclear energy, or gas, with lesser percentages generated by hydroelectric, diesel, and internal-combustion plants.

The lines of high-voltage transmission systems are usually composed of wires of copper, aluminum, which are suspended from tall latticework towers of steel by strings of porcelain insulators. By the use of clad steel wires and high towers, the distance between towers can be increased, and the cost of the transmission line thus reduced. In modern installations with essentially straight paths, high-voltage lines may be built with as few as eight towers to the kilometer. In some areas high-voltage lines are suspended from tall wooden poles spaced more closely together. For lower voltage sub transmission and distribution lines, wooden poles are generally used rather than steel towers. In cities and other areas where open lines create a hazard, insulated underground cables are used for distribution. Any electric-distribution system involves a large amount of supplementary equipment for the protection of

generators, transformers, and the transmission lines themselves. The system often includes devices designed to regulate the voltage delivered to consumers and to correct the power factor of the system.

Words and expressions

transmission of energy	передача энергии
economic advantage	экономическая выгода
utilization	использование
source	источник
alternating current	переменный ток
power systems	энергетические системы
lower voltage	более низкое напряжение
to consist of	состоять из
to raise the power	повышать напряжение
transmission line	передающая линия
to step down	понижать
the consumer's equipment	оборудование потребителя
electrical breakdown	выход из строя эл. оборудования
distribution level	уровень распределения
copper	медь
porclain insulator	керамический изолятор
underground cables	подземные кабеля
supplementary equipment	обязательное оборудование
power factor	коэффициент мощности

45. Ответьте на вопросы:

1. Can we state that the production and transmission of energy in the form of electricity is an important economic advantage?
2. Do electric power systems make possible the utilization of power at a distance from the source?
3. Why alternating current (AC) is generally used in modern power systems?
4. By means of what equipment the current is easily converted to higher or lower voltages?
5. Does an electric power system consist of six main elements? Name them.
6. Are transformers used to raise the generated power to the high voltages used on the transmission lines?
7. What does the central station of a power system consist of?
8. Why do we call a water or steam turbine as a prime mover?

9. Was most of the world's electric power in the early 1990s generated in steam plants?
10. What are the lines of high-voltage transmission system usually composed of?
11. How can the distance between towers be increased?
12. What are generally used for lower voltage sub transmission and distribution lines?
13. In cities and other areas where open lines create a hazard, insulated underground cables are used for distribution.
14. Where and why insulated underground cables are used for distribution?
15. How can you explain the fact that any electric-distribution system involves a large amount of supplementary equipment?
16. Does the system include devices designed to regulate the voltage?
17. What kind of equipment is used for protection of generators, transformers, and the transmission lines?
18. What do electric power systems include?

46. Найдите с тексте английские эквиваленты следующих слов и выражений:

Производство и передача электроэнергии; стоимость; единица энергии; источник; современные энергетические системы; трансформатор; шесть основных элементов; электрическая станция; передающие линии; подстанция; понижать; повышать; оборудование потребителя; поломка; уровень распределения; электрический генератор; медные провода; алюминий; керамические изоляторы; деревянные столбы; регулировать напряжение; коэффициент мощности.

47. Read and annotate the text

How Electric Power Systems operate

Electric power systems are used for the transformation of other types of energy into electrical energy and the transmission of this energy to the point of consumption.

Electric power systems transform mechanical energy into electrical energy and supply this to the end user.

Electric as power is a very cheap way of transferring power.

Electric power can be generated from renewable source – e.g. Hydro or Wind.

Alternating Current (AC) electricity is used because it can be transformed between voltage levels efficiently and easily as required.

This allows transmission lines from generator to operate a high voltage-low ampere and then local supplies at lower voltage higher ampere.

A typical generation system would consist of 6 stages:

1. The power generation station (1000V to 26000V 10000V)
2. Step up transformers to high voltage for long distance transmission (138000V to 765000V – 133000V)
3. Transmission lines (National grid)
4. Step down transformers at substations to lower the voltage for local transmission (69000V to 138000V - 10000V)
5. Transmission lines (Local grid)
6. Local substation to supply the consumer network (240V)

Rotating magnets inside a series of field coils generates electricity. The rotational movement is provided by steam, fluid or wind.

Most of the world power is generated by steam derived from coal, oil, gas or nuclear power source. The power source heats the water into steam at high pressure, which turns the turbine of the generator. Little power is generated from Hydro, Wind or internal combustion engines.

The National grid is a normally high steel tower carrying multi cables with a tower every 250-500M in straight lines.

Local grid is normally on tall wooden poles with few cables space every 100M. In towns underground distribution is used for safety reasons.

A complete delivery system includes protection circuits against overload or short circuits and form factor correction.

48. Ответить на вопросы:

1. Are electric power systems used for the transformation of other types of energy into electrical energy?
2. What are used for transmission of electric energy to the point of consumption?
3. Into what type of energy do electric power systems transform mechanical energy?
4. Is electricity a very expensive way of transferring power?
5. Can electric power be generated from renewable source? Give an example, please.
6. Can alternating current (AC) electricity be transformed between voltage levels efficiently and easily as required?
7. Does rotating magnets inside a series of field coils generate electricity?
8. What are the sources of a rotational movement of generator?
9. Is most of the world power generated by steam derived from coal, oil, gas or nuclear power source?
10. How do we call high steel towers carrying multi cables with a tower every 250-500M in straight lines?
11. How do we call the tall wooden poles with few cables space every 100 meter?

12. What does a complete delivery system include?

49. Найдите в тексте английские эквиваленты следующих слов и выражений:

Трансформирование энергии; точка потребления; дешёвый способ; передача электроэнергии; пополняемый источник; эффективно и легко; высоковольтный; низко амперный; низковольтный; высокоамперный; повышающий трансформатор; передающие линии; национальная электросеть; понижающий трансформатор; местная подстанция; вращение магнитов; обмотка; вращающий момент; выработанный пар; высокое давление; вращать турбину; стальные вышки; множество кабелей; защитные цепи.

50. Составьте предложения, используя данные слова и словосочетания:

1. Transform; energy; mechanical; electrical.
2. Source; generated; renewable; can be.
3. Electricity; alternating; current; efficiently; voltages; between.
4. Magnets; rotating; generated; electricity.
5. Steam; fluid; wind; provide; movement; rotational.
6. Steam; turbine; generator; turns.
7. High; steel; grid; national; towers; multi; cables.
8. Wooden; poles; local; grid; few; cables.
9. Protection; includes; system; delivery; circuits.

51. Переведите на английский язык следующие предложения:

1. Передача электроэнергии в точки потребления осуществляется по электрическим системам.
2. Электрическая энергия передаётся конечному потребителю по проводам.
3. Основными источниками выработки электрической энергии являются уголь, мазут и газ.
4. Типичная генерирующая система включает в себя 6 стадий.
5. Повышающие трансформаторы используются для передачи электроэнергии на большие расстояния.
6. Выражающий момент в генераторах обеспечивается различными видами топлива.
7. Большинство энергии в мире вырабатывается на тепловых станциях.
8. Пар высокого давления вращает турбину в генераторе.
9. Во избежание перегрузок и короткого замыкания в энергосистемах используются защитные цепи.

52. Read and annotate the text

In technologically advanced societies, the enormous consumption of energy per head is one aspect of the ever-increasing pressure man is placing on his environment. Early industrial man used three times as much energy as his agricultural ancestor; modern man is using three times as much as his industrial ancestor. If present trends continue, the rate of consumption will have tripled again by the end of the century. The problem lies in the fact that most of our current energy sources are finite. The hard truth is that a day will come when there is little or no exploitable coal, oil or natural gas anywhere. The sharp rise in the price of oil over the last decade has been unpleasant for many parts of the world but in the long run it is beneficial, partly because it discourages waste and partly because it has forced many nations to seek ways of developing better and more permanent sources of energy.

Energy sources may initially be divided into two kinds: non-renewable (i.e. finite) and renewable. The former group includes coal, oil, gas and, in the long run, nuclear; the latter hydropower, solar power and wind power. The energy from all these sources ultimately derives from the sun. There is a further source – geothermal – which depends on the earth's own heat. In practice this may be classed as nonrenewable as it is exploitable in only a few places and even there is limited.

Energy sources may be compared from several points of view:

a) renewability.

b) availability. Some energy sources may be excellent from some points of view but unlikely to contribute much at any time because of their limited geographical availability.

c) cost and efficiency. Some sources may be cheap but highly inefficient, even to a point where they are not practicable. Coal, for instance, though certainly practicable and comparatively cheap, is not very efficient (the efficiency even of a modern power station is only 35%). Geothermal sources, though in a sense free, would, in order to be maintained, end up by using more energy than they produced. Others, like oil, may be comparatively efficient but are in da nger of becoming prohibitively expensive.

53. Answer the following questions:

a) What are these trends, mentioned in paragraph1?

1. What has forced many nations to seek ways of developing better and more permanent sources of energy?
2. What are non-renewable sources of energy?
3. What source of energy is comparatively cheap, but not very efficient?
4. What source of energy is highly exploitable, but becoming prohibitively expensive?

b) 1. Is your home heated in winter and, if so, how? How is your food cooked?
2. Which kinds of fuel are used in your country to make electricity for industry and the home?
3. Are there any problems or difficulties in getting enough energy or paying for it?
4. Do you think the situation will have changed much in a hundred years' time and, if so, why?

54. Read and translate the following international words:

Electricity, civilization, economic and social progress, transformer, universal, electrometallurgy, cable, specific, machine, photocopying machine, radar, Paris, generator, battery, lamp, dynamo, indicator, nation, energy, service, laser, compact.

55. Read and translate the following words:

Imagine, turn, daily, completely, power, appearance, gear, pulley, whole, range, device, source, century, design, since, consumption, double, health, reduce, beam, advantages, clean, regulated, generate, human, latest.

56. Read and translate the text

Eectricity

application – применение
longstanding - долгосрочный
power cables- силовые кабели
transmission shafts – трансмиссионные валы
gear wheels – зубчатые колеса
belts and pulleys – ремни и блоки
time and labour-saving appliances – электроприборы, экономящие время и труд
dynamos and induction motors – динамо и индукционные моторы
consumption – потребление
per capita – на человека, на душу населения
by-products – побочные продукты
truly – поистине

It is impossible to imagine our civilization without electricity: economic and social progress will be turned to the past and our daily lives completely transformed.

Electrical power has become universal. Thousands of applications of electricity such as lighting, electrochemistry and electrometallurgy are longstanding and u nquestionable.

With the appearance of the electrical motor, power cables replaced transmission shafts, gear wheels, belts and pulleys in the 19-th century workshops. And in the home a whole range of various time and labour-saving appliances have become a part of our everyday lives.

Other devices are based on specific properties of electricity: electrostatics in the case of photocopying machine and electro magnetism in the case of radar and television. These applications have made electricity most widely used.

The first industrial application was in the silver workshops in Paris. The generator – a new compact source of electricity – was also developed there. The generator replaced the batteries and other devices that had been used before.

Electric lighting came into wide use at the end of the last century with the deve lopment of the electric lamp by Thomas Edison. Then the transformer was invented, the first electric lines and networks were set up, dynamos and induction motors were designed.

Since the beginning of the 20th century the successful development of electricity has begun throughout the industrial world. The consumption of electricity has doubled every ten years.

Today consumption of electricity per capita is an indicator of the state of development and economic health of a nation. Electricity has replaced other sources of energy as it has been realized that it offers improved service and reduced cost.

One of the greatest advantages of electricity is that it is clean, easily-regulated and generates no by-products. Applications of electricity now cover all fields of human activity from house washing machines to the latest laser devices. Electricity is the efficient source of some of the most recent technological advances such as the laser and electron beams. Truly electricity provides mankind with the energy of the future.

57. Answer the questions:

1. What is this text about? 2. What is electricity? (a source of electric power used in everyday life and industry) 3. What are the sources of electricity? (batteries, generators, electric motors and other devices). 4. What industrial applications of electricity do you know? (lasers and electronic devices) 5. What home applications of electricity do you know? (lighting, heating, radio, television, video, computers and many others) 6. Where was the generator developed? 7. Who invented the electric lamp? 8. What are the advantages of electricity (cleanness, easy regulation, no by products, low cost, improved service) 9. Can you imagine our life without electricity? Why?

58. Fill in the blanks with the words given above.

Electricity, increase, consumers, power, use, generation, reduce, consumption, far users, application, provide, sources, energy, light

We hear so much these days of local problems of electricity (1) ... Many (2) ... are taking steps to (3) ... their electricity (4) ... This is as a result of the recent (5) ... in electricity tariffs for (6) ... We should all try to (7) ... less (8) ..., by insulating our houses, turning off the (9) ... when leaving a room and using less hot water. We must try to develop alternative (10) ... of energy to (11) ... electricity for domestic and industrial (12) ... It is known that nuclear power comes to the consumer as electricity, which is clean and convenient form of (13) ... Although nuclear (14) ... stations are large, they can be built (15) ... from places where people live.

59. Прочтите следующий текст. Назовите основные структурные части данного текста (заглавие, головные строки, зачин, информационную часть, концовку). Скажите, в каком из структурных компонентов текста выражена его главная мысль.

Electric generators. Direct-current generators

A device for converting mechanical energy into electric energy is called a generator. The essential parts of a generator are: a) the magnetic field, which is produced by permanent magnets or electromagnets; and b) a moving **coil** of copper wire, called **the armature**, **wound** on a **drum**.

The construction and operation of **a. d. c. generator** are practically the same as those of **alternators**, the main differences being the **commutator** action, the method of field **excitation** and the necessity of always having the armature – the **rotating** member. This latter is required to permit the commutator to function.

The commutator consists of a number of **wedge-shaped** copper segments fitted together around one end of the armature. The segments are separated from each other by some insulating material. As a matter of fact thin sheets of **mica** are widely used. The two terminals of each armature coil are connected to **adjacent** commutator segments.

In practice, the **brushes** make contact on the **outer** surface of the commutators. The commutator progressively **switches** the brushes from one end of an armature coil to the other end, just as the coil starts to enter **the opposite pole area**. Thus although the direction of electron movement in the coil has reversed, the opposite end of the coil has been connected to the external circuit, direct current flowing out through the brush. Direct-current generators are usually self-excited, some of the energy generated by the armature being used to energize the field windings. This is impossible in alternators, because the direction of the field **flux** must be constant; therefore direct current is required as a field excitation source.

Sufficient residual magnetism remains in the field poles to generate a small voltage when the armature starts to revolve. This current, fed into the field windings, is found to strengthen the magnetic field, which in turn causes more voltage to be developed in the armature. This process continues until the generator has been brought up to operating speed.

D. c. generators are used for electrolytic processes. Large d. c. generators are used in certain manufacturing processes, such as steel making. Generators of small capacities are used for various special purposes, such as welding, train lighting, communication systems, automobile generators, etc.

60. Прочтите и выучите:

coil – катушка
armature – якорь (магнита или машины)
alternator – альтернатор, генератор переменного тока
excitation – возбуждение
rotating – вращающийся
wound – зд. разрез, насечка
drum – барабан
a. d. c. generator – генератор постоянного тока
commutator – коллектор, коммутатор, преобразователь тока
wedge-shaped – клинообразный
mica – слюда
adjacent – смежный, примыкающий, соседний
winding – обмотка
brush – щётка
outer – внешний, наружный
switch – переключать, включать, выключать
the opposite pole area – область противоположного полюса
flux – поток

61. Образуйте все возможные производные слова от данных:

operate, generate, alternate, commutate, insulate, separate, necessitate, energize, opposite, armature, sufficient, residual.

62. Найдите в тексте синонимы к следующим словам:

principal, to revolve, to call for, to allow, to be made up of, in effect, to apply, extensively, both, to join, to indicate, multiple, inner, in this way, though, motion, since, consequently, to begin, to go on, velocity.

56. Найдите в тексте антонимы к следующим словам:

different, the former, to connect, conducting, internal, possible, to weaken.

57. Переведите на английский язык следующие слова и их производные: *различаться*, различный, разница; возбуждать, возбуждение; вращаться, вращение, вращательный; двигаться, движение, движущий; требовать, требование; использовать, польза, полезный, бесполезный; достаточный, достаточно; сильный, сила, усиливать.

58. Найдите в тексте английские эквиваленты следующих слов и выражений. Составьте с ними предложения.

Ради, точно так же как, в свою очередь, заставлять, в действительности, на практике, таким образом, хотя, это невозможно, поэтому.

59. Ответьте на следующие вопросы, пользуясь информацией из текста

1. What is the difference between the construction and operation of a direct current generator and those oa alternators? 2. What segments does a commutator consist of? 3. How are the segments separated from each other? 4. What are the two terminals of each armature coil connected to? 5. How does the commutator operate? 6. How are direct current generators usually excited? 7. Why is this impossible in alternators? 8. What does sufficient residual magnetism in the field poles generate? 9. In what way is more voltage developed in the armature? 10. How long does this process continue?

60. Прочтите текст и найдите в каждой части по одному предложению, передающему основную мысль этой части.

Alternating-current generators

The principles underlying magnetism, electromagnetism and electromagnetic induction are combined in the creation of electrical energy from mechanical energy (generators) and in the creation of mechanical energy from electrical energy (motors). The generator consists of an outer frame or **yoke** to which are attached the pole pieces, always even in number, about which are erected the field windings. A cylinder of **laminated** iron called the armature, with **longitudinal slots** to contain the armature coils, is mounted on bearings so that it can rotate in the magnetic field set up by the pole pieces. One end of the armature terminates in a pair of **slip rings**. These are **solid brass** alloy rings fixed to the armature, the respective armature coil terminals being connected to each ring. Carbon brushes rest upon the slip rings in order to provide the current with a path to an external circuit. We know the field poles to be wound with wire in such a direction that the magnetic field strength is increased when direct current from an outside source is supplied to the field

windings. A variable resistance, referred to as a field **rheostat**, is placed in this circuit to permit control of the field strength.

Armature. The armature of a generator is rotated in the magnetic field between the field poles by some mechanical device. This may be a steam engine, a gasoline engine, an electric motor or some other **agency.** The rotation of the armature upon which the armature coils are wound causes the coils to cut the magnetic lines of force between the field poles. **Inasmuch** as the direction of electron flow is determined by the direction of conductor movement in relation to magnetic flux, current will flow in opposite directions in the opposite coil sides. This occurs because during one half **revolution** one side is moving up through the field, the other side moving down through it. In the next half revolution, however, the first side moves down through the field, while the second moves up. It is apparent that alternating current is generated and fed through the slip rings and brushes to the external circuit.

Frequency. The number of times per second the current reverses itself is known to be its frequency and is determined by the speed of the armature and the number of field poles. Thus a generator with two sets of field poles, whose armature turns 1 complete revolution per second (**rps**), would have frequency of 2 cycles. With one set of field poles, an armature must turn 2 rps to attain the same frequency.

61. Прочтите и выучите:

yoke – ярмо, хомут, скоба, зажим, *элк.* отклоняющая система (тж. magnetic yoke)
laminated – слоистый, пластинчатый
longitudinal – продольный
slot – паз, щель
slip ring – контактное кольцо
solid – твердый, сплошной
brass – латунь, желтая медь
rheostat – реостат
agency – действие, средство, фактор
inasmuch – так как
revolution – оборот, вращение
rps – обороты в минуту

62. Прослушайте следующие слова и повторите их:

brass, class, pass, path; out, about, outer, outside, found wound amount; pair, bearing; generator, operator, alternator, to laminate, to terminate, terminal, armature, variable, gasoline, agency, frequency; to attain, alloy, to occur, control, apparent; longitudinal.

63. Найдите в тексте синонимы к следующим словам:

to end, to supply, road, force, to name, to allow, to take place, to define, as, velocity, full, to reach, instrument, evident.

64. Найдите в тексте антонимы к следующим словам:

inside, up, internal, odd, to decrease.

65. Выберите одну из следующих тем и подготовьте сообщение на английском языке:

1. The frame or yoke of the generator. 2. The armature of the generator. 3. Brushes and slip rings. 4. The field poles. 5. The rotation of the armature. 6. Frequency.

III. FOSSIL FUELS

Text A. Fossil fuels

1. Read the text

Coal, oil and gas are called **''fossil fuels''** because they have been formed from the organic remains of prehistoric plants and animals.

How it works

Coal is crushed to a fine dust and burnt.

Oil and gas can be burnt directly.

The steam that has passed through the power station's turbines has to be cooled, to condense it back into water before it can be pumped round again. This is what happens in the huge "cooling towers" seen at power stations.

Some power stations are built on the coast, so they can use sea water to cool the steam instead. However, this warms the sea and can affect the environment, although the fish seem to like it.

More

Coal provides around 28 % of our energy, and oil provides 40 %. Mind you, this figure is bound to have changed since this page was written, so check the figures if you want to quote them.

Burning coal produces sulphur dioxide, an acidic gas that contributes to the formation of acid rain. This can be largely avoided using "flue gas desulphurisation" to clean up the gases before they are released into the atmosphere. This method uses limestone, and produces gypsum for the building industry as a by-product. However, it uses a lot of limestone.

Crude oil (called "petroleum") is easier to get out of the ground than coal, as it can flow along pipes. This also makes it cheaper to transport.

I ought to point out that some scientists are claiming that oil is not a 'fossil' fuel - that it is not the remains of prehistoric organisms after all. They claim it was made by some other, non-biological process. Currently this is not accepted by the majority of scientists, but you can find out more about the idea at space.com

Natural gas provides around 20 % of the world's consumption of energy, and as well as being burnt in power stations, is used by many people to heat their homes.

It is easy to transport along pipes, and gas power stations produce comparatively little pollution. Video clip: What is crude oil?

Other fossil fuels are being investigated, such as bituminous sands and oil shale. The difficulty is that they need expensive processing before we can use them; however Canada has large reserves of 'tar sands' , which makes it economic for them to produce a great deal of energy this way.

As far as we know, there is still a lot of oil in the ground. But although oil wells are easy to tap when they're almost full, it's much more difficult to get the oil up later on when there's less oil down there. That's one reason why we're increasingly looking at these other fossil fuels.

Is it renewable?

Fossil fuels are not a renewable energy resource.

Once we've burned them all, there isn't any more, and our consumption of fossil fuels has nearly doubled every 20 years since 1900.

This is a particular problem for oil, because we also use it to make plastics and many other products.

Ok, you could argue that fossil fuels are renewable because more coal seams and oil fields will be formed if we wait long enough.

However that means waiting for many millions of years. That's a long time - we'd have to wait around for longer than the time that humans have existed so far!

As far as we today are concerned, we're using it up very fast and it hardly gets replaced at all - so by any sensible human definition fossil fuels are not renewable.

2. Put the statements into the correct column. Analyze the advantages and disadvantages of fossil fuels.

Advantages	Disadvantages

1. Coal-fired power stations need huge amounts of fuel, which means train-loads of coal almost constantly. In order to cope with changing demands for power, the station needs reserves.
2. This means covering a large area of countryside next to the power station with piles of coal.

3. Gas-fired power stations are very efficient.

4. A fossil-fuelled power station can be built almost anywhere, so long as you can get large quantities of fuel to it.

5. Basically, the main drawback of fossil fuels is pollution.

6. Burning any fossil fuel produces carbon dioxide, which contributes to the "greenhouse effect", warming the Earth.

7. Very large amounts of electricity can be generated in one place using coal, fairly cheaply.

8. Transporting oil and gas to the power stations is easy.

9. Burning coal produces more carbon dioxide than burning oil or gas.

10. It also produces sulphur dioxide, a gas that contributes to acid rain. We can reduce this before releasing the waste gases into the atmosphere.

11. Mining coal can be difficult and dangerous. Strip mining destroys large areas of the landscape.

3. Answer the following questions and read the text below to check your answers.

1) What do you think was the very first source of energy for people?
2) How long have people been using wood as a fuel?

Text B. Wood fuel

Wood fuel is wood used as fuel. The burning of wood is currently the largest use of energy derived from a solid fuel biomass. Wood fuel can be used for cooking and heating, and occasionally for fueling steam engines and steam turbines that generate electricity. Wood fuel may be available as firewood (e.g. logs, blocks), charcoal, chips, sheets, and sawdust. The particular form used depends upon factors such as source, quantity, quality and application. Wood may be sent into a furnace to be burned, stove, fireplace, or in a campfire, or used for a bonfire. Wood is the most easily available form of fuel, and it is a renewable source of energy.

The use of wood as a fuel source for heating is as old as civilization itself.

Early examples include the use of wood heat in tents. Fires were constructed on the ground, and a smoke hole in the top of the tent allowed the smoke to escape by convection.

In permanent structures and in caves, hearths were constructed – surfaces of stone or another noncombustible material upon which a fire could be built. Smoke escaped through a smoke hole in the roof.

The Greeks, Romans, Celts, Britons, and Gauls all had access to forests suitable for using as fuel.

Total demand for fuel increased considerably with the industrial revolution but most of this increased demand was met by the new fuel source. Coal, which was more compact and more suited to the larger scale of the new industries.

The development of the chimney and the fireplace allowed for more effective exhaustion of the smoke. Masonry heaters or stoves went a step further by capturing much of the heat of the fire and exhaust in a large thermal mass, becoming much more efficient than a fireplace alone.

The metal stove was a technological development concurrent with the industrial revolution. Stoves were manufactured or constructed pieces of equipment that contained the fire on all sides and provided a means for controlling the draft. Stoves have been made of a variety of materials: cast iron, soapstone, tile, and steel. Metal stoves are often lined with refractory materials such as firebrick, since the hottest part of a wood burning fire will burn away steel over the course of several years' use.

The Franklin stove was developed in the United States by Benjamin Franklin. More a manufactured fireplace than a stove, it had an open front and a heat exchanger in the back that was designed to draw air from the cellar and heal it before releasing it out the sides. So-called ‘’Franklin’’ stoves today are made in a great variety of styles, though none resembles the original design.

The 1800s became the high point of the cast iron stove. Each local foundry would make their own design, and stoves were built for myriads of purposes– parlour stoves, camp stoves, railroad stoves, portable stoves, cooking stoves and so on. Wood or coal would be burnt in the stoves and thus they were popular for over one hundred years. The action of the fire, combined with the causticity of the ash, ensured that the stove would eventually disintegrate or crack over time. Thus a steady supply of stoves was needed. The maintenance of stoves, needing to be blacked, their smokiness, and the need to split wood meant that oil or electric heat found favour.

In the 19th century, the airtight stove, originally made of steel, became common. They allowed greater control of combustion, being more tightly fitted than other stoves of the day.

Use of wood heat declined in popularity with the growing availability of other, less labor-intensive fuels. Wood heat was gradually replaced by coal and later by fuel oil, natural gas and propane heating except in rural areas with available forests.

Today in rural, forested pails of the U.S., freestanding boilers are increasingly common. They are installed outdoors, some distance from the house, and connected to a heat exchanger in the house using underground piping. The mess of wood, bark, smoke and ashes is kept outside and the risk of fire is reduced.

The boilers are large enough to hold a fire all night, and can burn larger pieces of wood, so that less cutting and splitting is required. However, outdoor wood boilers emit more wood smoke and associated pollutants than other wood-burning appliances. This is due to design characteristics such as the water-filled jacket surrounding the firebox, which acts to cool the fire and leads to incomplete combustion. An alternative that is increasing in popularity are wood gasification boilers, which burn wood at very high efficiencies (85-91 %) and can be placed indoors or in an outbuilding.

As a sustainable energy source, wood fuel is still used today cooking in many places, either in a stove or air open fire, in many industrial processes, including smoking meat and making maple syrup, it also remains viable for generating electricity in areas with easy access to forest products and by-products.

Active vocabulary

4. Try to memorize the following words and phrases.

charcoal	уголь
campfire	костёр
exhaustion	истощение
sawdust	опилки
stove	плита
masonry heater	кирпичная печь
quantity	количество
bonfire	костер
thermal mass	тепловая масса
application	применение
convection	конвекция
draft	проект
furnace	печь
hearth	очаг
ash	зола
soapstone	мыльный камень
heat exchanger	теплообменник
causticity	каустичность
combustion	сгорание
purpose	цель
tile	плитка
to disintegrate	распадаться
to resemble	напоминать

to escape	избежать
concurrent	одновременный
portable	портативный
refractory	огнеупорный
incomplete	неполный
freestanding	автономный

5. Read the following international words and mind the stressed syllables.

boiler	factor	material
occasionally	energy	industrial
engine	civilization	revolution
curbines	construct	compact
generate	permanent	effective
popularity	structure	distance

6. Match the English and Russian equivalents.

a)	flammability	1) домашний очаг
b)	boiling point	2) бетонная промышленность
c)	byproduct	3) сжиженный природный газ
d)	heart	4) точка кипения
e)	rural area	5) побочный продукт
f)	conveyer belt	6) воспламеняемость
g)	concrete industry	7) сельская местность
h)	liquefied natural gas	8) транспортерная лента
i)	coal reserves	9) теплотворная способность
j)	heating value	10) запасы угля

7. Decide whether the following statements are true or false according to the text.

1) Stoves have been made of metal materials only.
2) «Franklin» stoves aren't made today.
3) Wood gasification boilers can be placed indoors or in an outbuilding.
4) Early examples include the use of wood heat near tents.
5) Total demand for fuel increased considerably with the industrial revolution.
6) Wood fuel remains viable in areas with easy access to forest.
7) Wood fuel can be used for cooking and heating, but can not be used for fueling steam engines.
8) This increased demand was met by the new fuel source - oil.

8. Put the following sentences in the correct order according to the text.

1) __ Masonry healers or stoves went a step further becoming much more efficient than a fireplace alone.
2) __ The 1800s became the high point of the cast iron stove.
3) __ The metal stove was a technological development concurrent with the industrial revolution.
4) __ The Greeks, Romans. Celts, Britons, and Gauls all had access to forests suitable for using as fuel.
5) __ In the 19th century the airtight stove, originally made of steel, became common.
6) __ Today in rural, forested parts of the U.S.. freestanding boilers are increasingly common.
7) __ So-called «Franklin» stoves today are made in a great variety of styles.
8) __ Most of total demand for fuel was met by the new fuel source, coal.

9. Answer the following questions.

1) What allowed more effective exhaustion of the smoke?
2) What materials have stoves been made of?
3) Where was the Franklin stove developed? What is its characteristic?
4) What were stoves built in the 1800s for?
5) What does the particular form of wood fuel used depend upon?
6) Is wood a renewable or non-renewable source of energy?
7) What is the earliest example of the use of wood as a fuel source?
8) What type of stoves became popular in the 19th century?
9) Why did the use of wood heat decline in popularity?
10) What is wood fuel?
11) What can wood fuel be used for?
12) Is it still used today? Where?

10. Divide the text into logical parts and make an oral report on the text according to the plan below.

Plan:

1. **The title**

.. I've read the text (article, story) entitled ...
I'd like to tell you about the text (article, story) entitled ...

2. **The source**

This is an article (story, text) published in the newspaper (magazine, book) ...

3. **The author**

The author of the text is ..., a famous writer (journalist, scientist).

4. **The idea**

The main idea of the text (article, story) is to show (to prove, to underline, to convince) ...

5. **The subject**

The text deals with …

The text describes (gives information about)...

6. **The content**

The text (story, article) starts with the fact (with the description of, with the characteristic of) ...

Then the author describes ...

After that the author touches upon the problem of ...

Next the author deals with the fact (the problem) ...

Besides the author stresses that ...

Finally the author comes to the conclusion that ...

7. **Your attitude**

My attitude to the article (story, text) is contradictory (complicated, simple)

On the one hand I agree that ...

On the other hand I can't agree that ...

I've learned a lot of interesting (important, new) facts (information, things) from the text.

It makes us think of …

It gives us food for thoughts.

It proves the idea (the theory, the point of view, the opinion) ...

It can help us in self-education (in solving our problems).

I'd like to cite the author (to make a quotation).

8. **Your advice**

So in my opinion it is (not) worth reading ...

11. Translate the following words and phrases into English using the vocabulary of the text.

Эффективное вытягивание, кирпичная печь, техническое развитие, способ управления тягой, огнеупорный материал, промышленная топка, разнообразные цели, вырабатывать электричество, капитальные сооружения, общий объем спроса, негорючий материал, промышленная революция, заслужили благосклонность, герметическая печь, трудоёмкое горючее, автономный котёл (бойлер), теплообменник, водоналивная облицовка, экологически устойчивый источник энергии.

12. Discuss with your groupmates or in pairs why coal and wood are considered to be traditional sources of energy.

Answer the following question and read the text below to check your answer.

Where do we use oil in everyday life?

Text C. Oil

Oil was formed from the remains of animals and plants (diatoms) that lived millions of years ago in a water environment before the dinosaurs. Over millions of years, the remains of these animals and plants were covered by layers of sand and silt. Heat and pressure from these layers helped the remains turn into what we today call crude oil.

Crude oil is a smelly, yellow-to-black liquid and is usually found in underground areas called reservoirs. Scientists and engineers explore a chosen area by studying rock samples from the earth. Measurements are taken, and, if the site seems promising, drilling begins. Above the hole a derrick is built to house the tools and pipes going into the well. When finished, the drilled well will bring a steady flow of oil to the surface.

Crude oil is called ‘’sweet’’ when it contains only a small amount of sulfur and ‘’sour’’ if it contains a lot of sulfur. Crude oil is also classified by the weight of its molecules. ‘’Light’’ crude oil flows freely like water, while ‘’heavy’’ crude oil is thick like tar. Crude oil is measured in barrels (bbls).

The world’s top five crude oil producing countries are Russia, Saudi Arabia, United States, Iran, China.

After crude oil is removed from the ground, it is sent to a refinery by pipeline, ship, or barge. A typical refinery costs billions of dollars to build and millions more to maintain. A refinery runs 24 hours a day, 365 days a year and requires a large number of employees to run it. A refinery can occupy as much land as several hundred football fields.

At a refinery, different parts of the crude oil are separated into useable petroleum products. Essentially, refining breaks crude oil down into its various components, which then are selectively reconfigured into new products. All refineries perform three basic steps: separation, conversion and treatment.

One barrel of crude oil, when refined, produces about 19 gallons of finished motor gasoline, and 10 gallons of diesel, as well as other petroleum products. Most petroleum products are used to produce energy, to move merchandise and people, help make plastics, and do many other things. For instance, many people across the United States use propane to heat their homes.

Other products made from petroleum include ink, crayons, bubble gum, dishwashing liquids, deodorant, eyeglasses, CDs and DVDs, tires, ammonia, heart valves.

Active vocabulary

13. Try to memorize the following words and phrases.

diatom	диатомовый
sample	образец
heart valve	клапан сердца
liquid	жидкость
crayon	цветной карандаш
propane	пропан
measurement	измерение
drilling	бурение
derrick	вышка
tools	инструментарий
pipe	труба
treatment	лечение
ammonia	аммиак
dishwashing liquid	средство для мытья посуды
molecule	молекула
barrel	баррель
refinery	очистительный завод
pipeline	трубопровод
diesel	дизельный
plastics	пластики
tire	шина
silt	ил
to explore	изучить
to house	размещать
to reconfigure	изменить настройки
to occupy	занимать
smelly	вонючий
essentially	по существу
selectively	избирательно
freely	свободно

14. Fill in the table with the derivatives.

Noun	Verb	Adjective
storage		
	to combust	
		dependent

15. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) sedimentary	a) plants
2) nonrenewable	b) rock
3) swampy	c) value
4) dead	d) layer
5) top	e) forests
6) plant	f) energy
7) heat	g) energy source
8) heating	h) rank
9) abundant	i) remains
10) raw	j) materials
11) moisture	k) mining
12) deep	l) machines
13) giant	m) reserves
14) coal	n) content
15) iron	o) furnaces
16) hot	p) ore

16. Complete the following sentences according to the text.

1) ‘’Light’’ crude oil flows … , while ‘’heavy’’ crude oil is ...
2) After crude oil is removed from the ground, it is sent to ...
3) A refinery runs ...
4) Oil was formed from ...
5) Scientists and engineers explore a chosen area by ...
6) Crude oil is called ‘’sweet’’ when it contains ... Crude oil is also classified by ...
7) One barrel of crude oil, when refined, produces ...

17. Decide whether the following statements are true or false according to the text.

1) Tools and pipes are housed in a derrick.
2) Crude oil is called «sour» if it contains a small quantity of sulfur.
3) A refinery is larger than a football field.
4) At a refinery, various pans of the crude oil are joined into useable petroleum products.
5) Propane is used by many Americans to heat their homes.
6) For years the remains of animals and plants were covered by layers of fine rocks.

18. Answer the following questions and give examples.

1) When does drilling begin?
2) What is crude oil measured in?
3) What are the main crude oil-producing countries?
4) What helped the remains to turn into crude oil?
5) Where is crude oil usually found in?
6) What are the steps performed at all refineries?
7) What are most petroleum products used for?
8) What do products made from petroleum include?

19. Find key words and phrases which best express the general meaning of each part.

20. Write a summary of Text C.

21. Make a presentation on the oil processing at a refinery. Find out additional information.

22. Answer the following question and read the text below to check your answer.

Why is natural gas the most popular source of energy nowadays?

Text D. Natural gas

Natural gas is a natural mixture of gaseous hydrocarbons found issuing from the ground or obtained from specially driven wells. The composition of natural gas values in different localities. Its chief component, methane, usually makes up from 80 % to 95 %, and the balance is composed of varying amounts of ethane, propane, butane, and other hydrocarbon compounds. Some of the hydrocarbons found in gasoline also occur as vapors in natural gas; by liquefying these hydrocarbons, gasoline can be obtained.

Although commonly associated with petroleum deposits it also occurs separately in sand, sandstone, and limestone deposits. Some geologists theorize that natural gas is a byproduct of decaying vegetable matter in underground strata, while others think it may be primordial gases that rise up from the mantle. Because of its flammability and high calorific value, natural gas is used extensively as an illuminant and a fuel.

Natural gas was known to the ancients but was considered by them to be a supernatural phenomenon because, noticed only when ignited, it appeared as a mysterious fire bursting from the ground. One of the earliest attempts to harness it for economic use occurred in the early 19th cent, in Fredonia, N.Y. Toward the latter part of the 19th cent., large industrial cities began to make use of natural gas, and extensive pipeline systems have been constructed to transport gas.

Liquefied natural gas, or LNG, is natural gas that has been pressurized and cooled so as to liquefy it for convenience in ship ping and storage. The boiling point of natural gas is extremely low, and only in the 1970s did cryogenic

technology advance enough to make the production and transport of LNG commercially feasible. Some of the natural gas moved to and from the United States is carried as LNG in special tankers.

Active vocabulary

23. Try to memorize the following words and phrases.

well	хорошо
limestone	известняк
mantle	мантия
vapor	пар
strata	слои
flammability	воспламеняемость
convenience	удобство
by-product	побочный продукт
tanker	танкер
illuminant	источник света
to theorize	теоретизировать
to issue	выдавать
liquefying	сжижение
decaying	разлагающийся
primordial	исконный
calorific	теплотворный
ignited	воспламеняемый
extensive	обширный
pressurized	герметичный
feasible	осуществимый
cryogenic	криогенный
separately	отдельно

Comprehension check

24. Complete the following sentences according to the text.

1) Natural gas is used extensively as an illuminant and a fuel be cause of its .
2) One of the earliest attempts to harness it for economic use occurred in ….
3) Liquefied natural gas is natural gas that has been ….
4) The composition of natural gas varies ….
5) The chief component of gas is ... .
6) Some geologists theorize that natural gas is ….
7) Others think it may be … .

25. Answer the following questions and give examples.

1) What was their idea about its origin?
2) When did the first attempt to harness it for economic use take place?
3) What is LNG?
4) What made the production and transport of LNG commercially feasible?
5) What is natural gas?
6) What is its chief component?
7) Does it occur in petroleum deposits only?
8) What are the main theories of gas origin?
9) What are its main properties?
10) Natural gas wasn't known to the ancients was it? Why? Why not?

26. Fill in the table according to the text.

Components	**Places of**	**Properties**	**Processes to liquefy**
…	…	…	…

27. Discuss with your groupmates or in pairs the advantages and disadvantages of natural gas as a source of energy.

28. Fill in the table with appropriate derivatives.

Flammability, calorific, extensively, illuminant, consider, phenomenon, ignite, harness, specially, different, chief, occur, commonly, petroleum, theorize, byproduct, primordial, industrial, pressurize, convenience, commercially, carry.

Verb	**Adjective**	**Noun**	**Adverb**
…	…	…	…

29. Translate the following texts into English using the active vocabulary.

1) Природный газ – ископаемое топливо. Состоит из углеводородов, содержится в осадочных, водах. Газ – газообразный компонент нефти, добывается из нефтяных скважин. Происхождение нефти и газа одинаково; разложение древних органических остатков. Перед использованием природного газа из него удаляют тяжёлые углеводороды – бутан и пропан, которые сжигают и помещают в металлические баллоны. Оставшийся «сухой газ» подаётся потребителю по трубопроводу. Включает в себя метан и этан.

2) Уголь – твёрдое топливо чёрного цвета, которое образовалось из остатков ископаемых растений. В каменноугольный и третичный периоды

болотистая растительность постепенно образовала торфяники. Накопление новых остатков вызывало проседание осадочных пород. Повышение давления и выделение тепла привело к образованию лигнита (бурого угля), битуминозного угля и при достаточно высокой температуре – антрацита. Уголь залегает в виде пластов, в более глубоких пластах увеличивается содержание углерода и снижается содержание природного газа и влажности. Поэтому лигнит – менее качественное топливо, чем антрацит.

30. Read the texts again and make notes under the following headings. Then use your notes to talk about Traditional sources of energy.

1. What wood fuel is and where it is used.
2. Coal origin, its properties, classification and harnessing.
3. Oil origin, its properties, refining process and harnessing.
4. What natural gas is, its origin, properties and process of liquefaction.

Text F. Coal

Coal is a combustible black or brownish-black sedimentary rock composed mostly of carbon and hydrocarbons. Coal is a non-renewable energy source because it takes millions of years to create. The energy in coal comes from the energy stored by plants that lived hundreds of millions of years ago, when the Earth was partly covered with swampy forests.

For millions of years, a layer of dead plants at the bottom of the swamps was covered by layers of water and dirt, trapping the energy of the dead plants. The heat and pressure from the top layers helped the plant remains turn into what we today call coal.

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

Anthracite contains 86 97 % carbon, and generally has a heating value slightly higher than bituminous coal. It accounts for less than 0,5 % of the coal mined in the United States.

Bituminous coal contains 45 – 86 % carbon. Bituminous coal was formed under high heat and pressure. Bituminous coal in the United States is between 100 to 300 million years old. It is the most abundant rank of coal found in the United States. Bituminous coal is used to generate electricity and is an important fuel and raw material for the steel and iron industries.

Subbituminous coal has a lower heating value than bituminous coal. It typically contains 35 45 % carbon. Most subbituminous coal in the United States is at least 100 million years old. About 46 % of the coal produced in the United States is subbituminous.

Lignite is the lowest rank of coal with the lowest energy content. Lignite coal deposits tend to be relatively young coal deposits that were not subjected to extreme heat or pressure, containing 25 – 35 % carbon. It is crumbly and has high moisture content.

Coal miners use giant machines to remove coal from the ground. They use two methods: surface or underground mining. Modern mining methods allow us to easily reach most of our coal reserves.

Surface mining is used to produce most of the coal in the US because it is less expensive than underground mining. Surface mining can be used when the coal is buried less than 200 feet underground.

Underground mining, sometimes called deep mining, is used when the coal is buried several hundred feet below the surface. Some underground mines are 1,000 feet deep.

After coal comes out of the ground, it typically goes on a conveyor belt to a preparation plant that is located at the mining site. The plant cleans and processes coal to remove other rocks and dirt, ash, sulfur, and unwanted materials, increasing the heating value of the coal.

After coal is mined and processed, it is ready to be shipped to market.

Coal is used to create almost half of all electricity generated in the US. Power plants bum coal to make steam. The steam turns turbines that generate electricity.

A variety of industries use coal's heat and by-products. Separated ingredients of coal (such as methanol and ethylene) are used in making plastics, tar, synthetic fibers, fertilizers, and medicines.

Coal is also used to make steel. Coal is baked in hot furnaces to make coke, which is used to smelt iron ore into iron needed for making steel. It is the very high temperatures created from the use of coke that gives steel the strength and flexibility for things like bridges, buildings, and automobiles. The concrete and paper industries also use large amounts of coal.

Active vocabulary

31. Try to memorize the following words and phrases.

sedimentary rock	осадочная порода
carbon	углерод
pressure	давление
dead plants	мёртвые растения

hydrocarbon	углеводород
remains	остатки
top layer	верхний слой
content	содержание
ethylene	этилен
coke	кокс
anthracite	антрацит
depth	глубина
sulfar	сера
lignite	бурый уголь
heating value	теплотворная способность
methanol	метанол
tar	смола
raw material	сырье
deposit	месторождение
moisture	влага
surface mining	открытый способ добычи
steam	пар
flexibility	гибкость
underground mining	подземные горные работы
synthetic fibers	гетические волокна
reserves	запасы
conveyer belt	конвейерная лента
preparation plant	обогатительная фабрика
iron ore	железная руда
power plant	электростанция
to trap	поймать
to create	создать
to sink	тонуть
to compose of	составить из
to contain	содержать
to account	отчитываться
to mine	добывать
to be subjected to	подвергаться
to process	обработать
to ship	отправить
to bake	испечь
to smelt	пахнуть
swampy	болотистый

bituminous	битумный
abundant	обильный
crumbly	рассыпчатый
subbituminous	суббитуминозный
expensive	дорогой

32. Finish the following sentences according to the text.

1) The rank of a deposit of coal depends on ...
2) Bituminous coal contains …
3) … is the lowest rank of coal with the lowest energy content.
4) Lignite coal deposits were not subjected to …
5) Coal is composed of…
6) The energy in coal comes from the energy ...
7) A layer of dead plants was covered by ...
8) Coal miners use giant machines ...
9) Surface mining can be used when the coal is buried ..
10) Underground mining is used when the coal is buried ...

33. Decide whether the following statements are true or false.

1) Surface mining is cheaper than underground mining,
2) Rocks and dirt, sulfur and unwanted materials are removed from coal at a preparation plant.
3) Coal is burnt by power plants to make steam.
4) Coke is used for smelting iron ore into iron.
5) Coal is an inflammable black or brown sedimentary rock.
6) The pressure and heat from the top layers helped the plant remains turn into coal.
7) Bituminous coal formed about 100 to 300 million years ago is the least widespread rank of coal in the US.
8) Bituminous coal has a higher heating value than subbituminous coal.
9) Lignite is a relatively young coal deposit.
10) The strength and flexibility are given to steel by the use of coke.

34. Answer the questions and give examples.

1) How much carbon does subbituminous contain?
2) What type of coal is crumbly and has a high moisture content?
3) What are the two methods of mining coal?
4) What is done at the plant?
5) When is coal ready to be shipped to market?
6) Why is coal a nonrenewable energy source?

7) What does the classification of coal depend on?
8) How much carbon does anthracite contain?
9) Do the steel and iron industries use bituminous coal? Why? Why not?
10) How is coke made?

35. Fill in the following table and answer the questions below.

Type of coal	**Quantity of carbon**	**Quantity mined in the US**	**Heating value**	**Pecularities**
Anthracite	…	…	the highest	…
…	…	about 50 %	…	…
…	…	…	…	100 mln years old
…	25 – 35 %	…	…	…

1) What type of coal is the most valuable? Why?
2) What type of coal is the most widespread in the USA?

36. What parts of the text can you define? Do they correspond to the paragraphs? Name each part.

1._____ 4._____
2._____ 5._____
3._____ … _____

37. Find key words and phrases, which best express the general meaning of each part.
38. Write a summary of Text F.
39. Discuss with your groupmates or in pairs what ranks of coal are mined in Russia (Find out additional information).

NATURAL GAS

Text A. Natural gas distribution system

Natural gas is a fossil fuel. It is a gaseous molecule that's made up of two atoms – one carbon atom combined with four hydrogen atom. It's chemical formula is CH4. The picture on the right is a model of what the molecule could look like.

Don't confuse natural gas with "gasoline," which we call ‘’gas’’ for short. Like oil, natural gas is found under ground and under the ocean floor. Wells are drilled to

tap into natural gas reservoirs just like drilling for oil. Once a drill has hit an area that contains natural gas, it can be brought to the surface through pipes.

The natural gas has to get from the wells to us. To do that, there is a huge network of pipelines that brings natural gas from the gas fields to us. Some of these pipes are two feet wide.

Natural gas is sent in larger pipelines to power plants to make electricity or to factories because they use lots of gas. Bakeries use natural gas to heat ovens to bake bread, pies, pastries and cookies. Other businesses use natural gas for heating their buildings or heating water.

From larger pipelines, the gas goes through smaller and smaller pipes to your neighborhood.

In businesses and in your home, the natural gas must first pass through a meter, which measures the amount of fuel going into the building. A gas company worker reads the meter and the company will charge you for the amount of natural gas you used.

Energy can be found in a number of different forms. It can be chemical energy, electrical energy, heat (thermal energy), light (radiant energy), mechanical energy, and nuclear energy.

In some homes natural gas is used for cooking, heating water and heating the house in a furnace.

In rural areas, where there are no natural gas pipelines, propane (another form of gas that's often made when oil is refined) or bottled gas is used instead of natural gas. Propane is also called LPG, or liquefied petroleum gas, is made up of methane and a mixture with other gases like butane.

Propane turns to a liquid when it is placed under slight pressure. For regular natural gas to turn into a liquid, it has to be made very, very cold.

Cars and trucks can also use natural gas as a transportation fuel, but they must carry special cylinder–like tanks to hold the fuel.

When natural gas is burned to make heat or burned in a car's engine, it burns very cleanly. When you combine natural gas with oxygen (the process of combustion), you produce carbon dioxide and water vapor; plus the energy that's released in heat and light.

Some impurities are contained in all natural gas. These include sulphur and butane and other chemicals. When burned, those impurities can create air pollution. The amount of pollution from natural gas is less than burning a more "complex" fuel like gasoline. Natural gas-powered cars are more than 90 percent cleaner than a gasoline-powered car.

That's why many people feel natural gas would be a good fuel for cars because it burns cleanly (source: http://www.energyquest.ca).

What is natural gas used for in homes?

Text B. Residential use

Natural gas is one of the cheapest forms of energy available to the residential consumer. In fact, natural gas has historically been much cheaper than electricity as a source of energy. According to the Department of Energy (DOE) natural gas costs less than 30 percent of the cost of electricity, per Btu.

Not only is natural gas cheap for the residential consumer, it also has a number of varied uses. The best known uses for natural gas around the home are natural gas heating and cooking. Cooking with a natural gas range or oven can provide many benefits, including easy temperature control, self-ignition and self-cleaning, as well as being approximately one–half the cost of cooking with an electric range.

Natural gas is one of the most popular fuels for residential heating. This popularity is also shown through the high proportion of new homes built with natural gas heating.

Despite his increase in the proportion of homes using natural gas the actual volume of natural gas consumed has not increased to the same degree due to increased efficiency of natural gas appliances. Modern top of the line gas furnaces can achieve efficiencies of over 90 percent (meaning that only 10 percent of the energy contained in the natural gas is lost as waste heat).

In addition to healing homes, natural gas can also be used to help cool houses, through natural gas powered air conditioning. Natural gas air conditioning is nothing new; in fact, it provided most of the air conditioning requirements of the 1940's and 50's. However, due to new advancements in technology and efficiency, natural gas air conditioning is experiencing resurgence in popularity. Although natural gas air conditioner units are initially more expensive than a comparable electric unit, they are considerably more efficient and require less maintenance.

Natural gas appliances are also rising in popularity due to their efficiency and cost effectiveness. Although many gas powered appliances are initially more expensive than their electric counterparts, they are commonly much cheaper to operate, have a longer expected life, and require relatively low maintenance. Some examples of other natural gas appliances include space heaters, clothes dryers, pool and jacuzzi heaters, fireplaces, barbecues, garage heaters, and outdoor lights. All of these appliances offer a safe, efficient, and economical alternative to electricity or other fuel sources.

Although natural gas has many uses, and can supply energy to a vast number of residential appliances, there are some energy requirements around the house

which cannot be satisfied by natural gas. A television, or blender, or microwave, for instance, will likely never be powered directly by natural gas, but will instead require electricity. However, natural gas can still provide energy for these appliances at home, by what is known as 'distributed generation'.

Distributed generation refers to using natural gas to generate electricity right on the doorstep. Natural gas fuel cells and micro turbines both offer the residential consumer the capacity to disconnect from their local electric distributor, and generate just enough electricity to meet their needs. Although this technology is still in its infancy, it is very promising in being able to offer independent, reliable, efficient, environmentally friendly electricity for residential needs.

The very first natural gas fuel cell was installed in a house in Latham, New York, in July 1998. The system was plugged into the home's natural gas line as the fuel supply, and is now completely independent of any outside electricity. Because a significant amount of electricity is wasted when it is distributed through power lines from a central power plant to the home, on– site electric generation could lead to significantly higher energy efficiency, which translates to cost savings for the residential consumer (source: www.energyquest.ca).

Active vocabulary

40. Try to memorize the following words and phrases.

resurgence	возрождение
consumer	потребитель
self ignition	самовоспламенение
advancement	продвижение
counterparts	коллеги
requirement	требование
infancy	младенчество
appliance	прибор
to disconnect	отключить
to plug	подключить
to offer	предложить
to provide	обеспечить
residential	жилой
versatile	разносторонний
comparable	сопоставимый
distributed	распределенный
reliable	надежный
initially	

approximately	первоначально
consider	приблизительно
	по соображениям

41. Choose the right word.

For hundreds of years, natural gas has been known as a very *(useful / useless)* substance. The Chinese *(discovered*/*invented)* a very long time ago that the energy in natural gas could be harnessed, and used to *(heat / cool)* water. In the early days of the natural gas industry, the gas was mainly used to *(light / heal)* street– lamps, and the occasional *(house /place).*

There are so many *(different /special)* applications for this fossil fuel: commercially, in your home, in industry, and even in the transportation sector!

For example, energy from *(natural / man – made)* gas accounts *(for / at)* 24 percent of total energy consumed in the United States, making it a vital component of the nation's energy *(supply /demand).*

42. Decide whether the following statements are true or false according to the text.

1) Natural gas is widely used in air conditioning systems.
2) Natural gas air conditioner units are initially more expensive than a comparable electric unit.
3) Gas powered appliances require relatively low maintenance.
4) Electricity has historically been much cheaper than natural gas as a source of energy.
5) Natural gas is used around the home for heating as well as cooling.
6) No energy contained in the natural gas is lost as waste heat.
7) Such devices as a TV set or microwave will unlikely be powered directly by natural gas.
8) Natural gas fuel cells offer the residential consumer the capacity to disconnect from their local electric distributor.
9) The very first natural gas fuel cell was installed m a house in Latham, New York, in June 1998.
10) No electricity is wasted when it is distributed through power lines from a central power plant to the home.

43. Answer the following questions and give examples.

1) Can natural gas be used to cool houses? Why? Why not?
2) Why are natural gas appliances rising in popularity?
3) What are they?

4) Are electric or gas powered appliances cheaper to install? Why? Why not?
5) What energy requirements around the house cannot be satisfied by natural gas?
6) What is the lowest cost conventional energy source available for residential use?
7) What are the best known uses for natural gas around the home?
8) What are the benefits provided with cooking by natural gas?
9) What efficiency can modern top of line gas furnaces achieve?
10) Is natural gas air conditioning experiencing decline in popularity?

44. Choose the best abstract for the text.

1. Natural gas is a cheap, efficient source of energy for the residential consumer and has a variety of uses around the house.
2. Natural gas has been harnessed in residential use for a long time and it is more efficient than electricity.
3. Natural gas can be used not only for heating and cooling but for a number of varied residential uses.

45. Discuss with your groupmates or in pairs what is more ecologically friendly: electricity or natural gas.

46. Translate the following words and phrases into English using the vocabulary of the text.

Распределительное производство, топливный элемент, быть на начальной стадии развития, быть многообещающим, безвредный к окружающей среде, доступная форма, потребитель, обеспечивать выгоду, отопление жилого помещения, возрождение популярности, предполагаемый срок службы, комнатный обогреватель, требовать меньше текущего обслуживания, дешевый в эксплуатации, значительное количество, экономия в расходах.

47. Answer the following question and read the text below to check your answer.

What is natural gas used for in commercial sector?

Text C. Commercial uses

Commercial uses of natural gas are very similar to residential uses. The commercial sector includes public and private enterprises, like office buildings, schools, churches, hotels, restaurants and government buildings. The main uses of natural gas in this sector include space heating, water heating, and cooling. For

restaurants and other establishments that require cooking facilities, natural gas is a popular choice to fulfill these needs.

Natural gas currently accounts for 13 percent of energy used in commercial cooling, but this percentage is expected to increase due to technological innovations in commercial natural gas cooling techniques. There are three types of natural gas driven cooling processes. Engine driven chillers use a natural gas engine, instead of an electric motor, to drive a compressor. With these systems, waste heat from the gas engine can be used for healing applications, increasing energy efficiency. The second category of natural gas cooling devices consist of what are called absorption chillers, which provide cool air by evaporating a refrigerant like water or ammonia. These absorption chillers are best suited to cooling large commercial buildings, like office towers and shopping malls. The third type of commercial cooling system consists of gas-based desiccant systems. These systems cool by reducing humidity in the air. Cooling this dry air requires much less energy than it would to cool humid air.

Another area of growth in commercial natural gas use is in the food service industry as it is a flexible energy source in being able to supply the food service industry with appliances that can cook food in many different ways. New developments such as Nontraditional Restaurant Systems, which provide compact, multifunctional natural gas appliances for smaller sized food outlets such as those found in shopping malls and airports, are expanding the commercial use of natural gas. These types of systems can integrate a gas-fired fryer, griddle, oven, hot and cold storage areas, and multiple venting options in a relatively small space – providing the ease and efficiency of natural gas cooking while being compact enough to serve small kiosk type establishments.

In addition to traditional uses of natural gas, a number of technological advancements have allowed natural gas to be used to increase energy efficiency in commercial settings. Many buildings, because of their high electricity needs, have on-site generators that produce their own electricity. Natural gas powered reciprocating engines, turbines, and fuel cells are all used in commercial settings to generate electricity. These types of “distributed generation” units offer commercial environments more independence from power disruption, high- quality consistent electricity, and control over their own energy supply.

Another technological innovation brought about is combined heating and power (CHP) and combined cooling, heating and power (CCHP) systems, which are used in commercial settings to increase energy efficiency. These are integrated systems that are able to use energy that is normally lost as heat. For example, heat that is released from natural gas powered electricity generators can be harnessed to run space or water heaters, or commercial boilers. Using this normally wasted energy can dramatically improve energy efficiency.

Active vocabulary

47. Try to memorize the following words and phrases.

private enterprise	частное предприятие
absorption	поглощение
refrigerant	холодильный
establishment	создание
chiller	холодильник
desiccant	осушитель
humidity	влажность
appliance	прибор
outlet	выход
fryer	фритюрница
griddle	жарить на сковородке
venting options	варианты вентиляции
disruption	нарушение
commercial settings	коммерческие условия
consistent electricity	последовательное электричество
to fulfill	выполнить
to integrate	интегрировать
to absorb	поглощать
to evaporate	испаряться
to expand	расширить

49. Complete the following sentences according to the text.

1) Natural gas currently ...
2) Engine driven chillers use ...
3) The second category consist of...
4) The third type of commercial cooling system consists . .
5) Another area of growth in commercial natural gas use is ...
6) The commercial sector includes ...
7) The main uses of natural gas in this sector include ...
8) For restaurants natural gas is ...
9) In addition to traditional uses ...
10) Another technological innovation is ...

50.Answer the following questions and give examples.

1) How is natural gas used in buildings with high electricity needs?
2) What technological innovation to increase energy efficiency do you know?
3) According to the given graph, which commercial sector has the least natural gas harnessing?

4) What does the commercial sector include?
5) What are the main uses of natural gas in this sector?
6) How many types of natural gas driven cooling processes do you know? What are they?
7) Why is natural gas broadly harnessed in the food service industry?

51. Divide the text into logical parts and make an oral report on the text.

52. Fill in the table with appropriate derivatives.

Generation, currently, commercial, improve, dramatically, on– site, expand, technique, normally, desiccant, account, choice, relatively, public, require, refrigerant, high– quality, chiller, harness.

Adverb	Verb	Adjective	Noun

53. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1)	to require	a) cell
2)	to fulfill	b) heating
3)	desiccant	c) efficiency
4)	fuel	d) facilities
5)	distributed	e) innovations
6)	space	f) system
7)	technological	g) generation
8)	energy	h) needs

54. Match the opposites.

1) heating	a) slightly
2) natural	b) humidifier
3) to improve	c) to decrease
4) to increase	d) to deteriorate
5) desiccant	e) extended
6) flexible	f) similar
7) compact	g) cooling
8) different	h) fixed
9) disruption	i) artificial
10) dramatically	j) combination

55. Answer the following question and read the text below to check your answer.

What is the natural gas used for in industry?

Text D. Uses in industry

Natural gas has a multitude of industrial uses, including providing the base ingredients for such varied products as plastic, fertilizer, antifreeze, and fabrics. In fact, industry is the largest consumer of natural gas, accounting for 43 % of natural gas us across all sectors. Natural gas is the second most used energy source in industry, trailing only electricity.

Industrial applications for natural gas are many, including the same uses found in residential and commercial settings – healing, cooling, and cooking. Natural gas is also used for waste treatment and incineration, metals preheating (particularly for iron and steel), drying and dehumidification, glass melting, food processing, and, fueling industrial boilers. Gases such as butane, ethane, and propane may be extracted from natural gas to be used as a feedstock for such products as fertilizers and pharmaceutical products.

Natural gas is converted to what is known as synthesis gas, which is a mixture of hydrogen and carbon oxides formed through a process known as steam reforming. In this process, natural gas is exposed to a catalyst that causes oxidization of the natural gas when brought into contact with steam. This synthesis gas, once formed, may be used to produce methanol (or Methyl Alcohol), which in turn is used to produce such substances as formaldehyde, acetic acid, and MTBE (methyl tertiary butyl ether) that is used as an additive for cleaner burning gasoline. Methanol may also be used as a fuel source in fuel cells.

In addition to these uses, there are a number of innovative and industry specific uses of natural gas. Natural gas desiccant systems, which are used for dehumidification, are increasingly popular in the plastics, pharmaceutical, candy, and even recycling industries. Adding a natural gas desiccant system to the manufacturing or diving environment allows industrial users to regulate more closely the amount of moisture in the air, leading to a more consistent and high–quality product.

Natural gas absorption systems are also being used extensively in industry to heat and cool water in an efficient, economical, and environmentally sound way. These industrial absorption systems are very similar to those used in commercial settings.

Active vocabulary

56. Try to memorize the following words and phrases.

waste treatment	обработка отходов
steam reforming	паровой риформинг
incineration	сжигание
feedstock	сырье
catalyst	катализатор
recycling industry	перерабатывающая промышленность
formaldehyde	формальдегид
butane	бутан
dehumidification	обезвоживание
acetic acid	уксусная кислота
additive	добавка
fueling	заправка топливом
natural gas absorption system	естественная система поглощения газов
natural gas desiccant system	естественная система осушителя газа
to extract	извлечения
to trail	плестись

57. Complete the following sentences according to the text.

1) Synthesis gas is a mixture of...
2) ... is used as an additive for cleaner burning gasoline.
3) Natural gas desiccant systems are increasingly popular in ...
4) Natural gas has a multitude of industrial uses, including...
5) Butane, ethane and propane are used as a feedstock for ...
6) Adding a natural gas desiccant system to the manufacturing or drying environment allows industrial users to …

58. Correct the following statements.

1) There are a few innovative and industry specific uses of natural gas.
2) The regulation of the amount of gas in the air leads to a more consistent and high–quality product.
3) Natural gas is the largest most used energy source in industry.
4) Synthesis gas may be used to produce formaldehyde, acetic acid and MTBE.
5) The industrial absorption systems differ from those used in commercial settings.

59. Answer the following questions and give examples.

1) What are the industrial applications of natural gas?
2) What gases may be extracted from natural gas?
3) What is steam reforming?
4) Is industry the largest consumer of natural gas? Why? Why not?
5) Where may methanol be used as a fuel source?
6) What are natural gas desiccant systems used for?
7) Why are natural gas absorption systems being widely used in industry?

60. Find key words and phrases which best express the general meaning of each paragraph.

61. Write a summary of Text D.

62. Combine the words from the column on the left with the suitable nouns from the column on the right. Translate them into Russian.

1) glass	a) application
2) base	b) treatment
3) industrial	c) reforming
4) pharmaceutical	d) ingredients
5) high–quality	e) system
6) waste	f) products
7) steam	g) melting
8) desiccant	h) products
9) absorption	i) systems
10) commercial	j) settings

NUCLEAR POWER

Text A. Energy Resources: Nuclear power

How it works

Nuclear power stations work in pretty much the same way as fossil fuel–burning stations, except that a "chain reaction" inside a nuclear reactor makes the heat instead.

The reactor uses Uranium rods as fuel, and the heat is generated by nuclear fission: neutrons smash into the nucleus of the uranium atoms, which split roughly in half and release energy in the form of heat.

Carbon dioxide gas or water is pumped through the reactor to take the heat away, this then heats water to make steam.

The steam drives turbines which drive generators.

Modern nuclear power stations use the same type of turbines and generators as conventional power stations.

In Britain, nuclear power stations are often built on the coast, and use sea water for cooling the steam ready to be pumped round again. This means that they don't have the huge "cooling towers" seen at other power stations.

The reactor is controlled with "control rods", made of boron, which absorb neutrons. When the rods are lowered into the reactor, they absorb more neutrons and the fission process slows down. To generate more power, the rods are raised and more neutrons can crash into uranium atoms.

More

Natural uranium is only 0.7% "uranium – 235", which is the type of uranium that undergoes fission in this type of reactor.

The rest is U – 238, which just sits there getting in the way. Modern reactors use "enriched" uranium fuel, which has a higher proportion of U – 235.

The fuel arrives encased in metal tubes, which are lowered into the reactor whilst it's running, using a special crane sealed onto the top of the reactor.

With an AGR or Magnox station, carbon dioxide gas is blown through the reactor to carry the heat away. Carbon dioxide is chosen because it is a very good coolant, able to carry a great deal of heat energy. It also helps to reduce any fire risk in the reactor (it's around 600 degrees Celsius in there) and it doesn't turn into anything nasty (well, nothing long-lived and nasty) when it's bombarded with neutrons.

You have to be very careful about the materials you use to build reactors – some materials will turn into horrible things in that environment. If a piece of metal in the reactor pressure vessel turns brittle and snaps, you're probably in trouble – once the reactor has been built and started you can't go in there to fix anything.

Uranium itself isn't particularly radioactive, so when the fuel rods arrive at the power station they can be handled using thin plastic gloves. A rod can last for several years before it needs replacing.

It's when the "spent" fuel rods are taken out of the reactor that you need the full remote - control robot arms and Homer Simpson equipment.

Should I worry about nuclear power?

Nuclear power stations are not atomic bombs waiting to go off, and are not prone to "meltdowns".

There is a lot of U – 238 in there slowing things down – you need a high concentration of U – 235 to make a bomb.

If the reactor gets too hot, the control rods are lowered in and it cools down.

If that doesn't work, there are sets of emergency control rods that automatically drop in and shut the reactor down completely.

With reactors in the UK, the computers will shut the reactor down automatically if things get out of hand (unless engineers intervene within a set time). At Chernobyl, in Ukraine, they did not have such a sophisticated system, indeed they over-rode the automatic systems they did have. When they got it wrong, the reactor overheated, melted and the excessive pressure blew out the containment system before they could stop it. Then, with the coolant gone, there was a serious fire. Many people lost their lives trying to sort out the mess. A quick web search will tell you more about this, including companies who operate tours of the site.

If something does go wrong in a really big way, much of the world could be affected some radioactive dust (called "fallout") from the Chernobyl accident landed in the UK. That's travelled a long way.

With AGR reactors (the most common type in Britain) there are additional safety systems, such as flooding the reactor with nitrogen and/or water to absorb all the neutrons although the water option means that reactor can never be restarted.

So should I worry? I think the answer is "so long as things are being done properly, I don't need to worry too much. The bit that does worry me is the small amount of high-level nuclear waste from power stations. Although there's not much of it, it's very, very dangerous and we have no way to deal with it apart from bury it and wait for a few thousand years...

There are many different opinions about nuclear power, and it strikes me that most of the people who protest about it don't have any idea what they're talking about. But please make up your own mind, find out as much as you can, and if someone tries to get you to believe their opinion ask yourself "what's in it for them?"

Is it renewable?

Nuclear energy from Uranium is not renewable. Once we've dug up all the Earth's uranium and used it, there isn't any more.

Actually, it's not that simple – we can use "fast breeder" reactors to convert uranium into other nuclear fuels whilst also getting the energy from it. There are two types of breeder reactors – ones that make weapons– grade plutonium and ones that are for energy production

63. Answer the following question and read the text below to check your answer.

Why can nuclear power be considered as an alternative to fossil fuels?

Text B. Nuclear power

When you hear the words "nuclear power", different images may flicker through your mind: concrete coolant towers emitting torrents of steam or a mushroom cloud rising high into the sky.

Some people praise the technology as a low-cost, low-emission alternative to fossil fuel, while others stress the negative impact of nuclear waste and accidents such as Three Mile island and Chernobyl. There's a lot of discussion out there about nuclear power's role in our lives, but what's going on at the heart of these power plants? As of July 2008, there were more than 430 operating nuclear power plants and, together, they provided about 15 percent of the world's electricity in 2007. Of these 31 countries, some depend more on nuclear power than others. For instance, in France about 77 percent of the country's electricity comes from nuclear power Lithuania comes in second, with an impressive 65 percent. In the United States, 104 nuclear power plants supply 20 percent of the electricity overall, with some states benefiting more than others.

Despite all the cosmic energy that the word "nuclear" invokes, power plants that depend on atomic energy don't operate that differently from a typical coal burning power plant. Both heat water into pressurized steam, which drives a turbine generator. The key difference between the two plants is the method of heating the water. While older plants burn fossil fuels, nuclear plants depend on the heat that occurs during nuclear fission, when one atom splits into two (source: www.naturalgaz.org).

Active vocabulary

64. Try to memorize the following words and phrases.

coolant	хладагент
torrent	поток
image	изображение
coal– burning	угле сжигающий
flicker	мерцать
to praise	хвалить
to invoke	вызывать
to emit	испускать
cosmic	космический
impressive	впечатляющий
overall	в общем

65. Choose the right word.

1) Nuclear power is *(reduced/generated/ increased)* using Uranium, which is a metal mined in various *(parts / kinds / stages)* of the world.

2) The first large–scale nuclear power station *(demolished /closed/opened)* at Calder Hall in Cumbria, England, in 1956.

3) Some *(cargo / civil / military)* ships and submarines have nuclear power plants for *(chambers / engines /fission).*

4) *(Metal / concrete)* plays an important role in containing *(nuclear / radioactive)* materials.

66. Answer the following questions and give examples.

1) What do statistics of 2008 show?
2) What countries depend on nuclear power more than others?
3) What is the same about nuclear power and coal burning power plants?
4) What is the key difference between them?
5) What is fission?
6) What are people's opinions related to nuclear power?
7) What accidents make them feel negative?
8) How many countries depend on nuclear power?
9) When you hear the words "nuclear power", what do you imagine?
10) Is there any difference between words "nuclear" and "atomic"?

67. Decide whether the following statements are true or false according to the text.

1) They provided more than 15 percent of the world's electricity in 2008.
2) In France about 77 percent of the country's electricity comes from nuclear power.
3) In Baltic republics nuclear power plants supply 65 percent of the electricity overall.
4) The technology of nuclear power is a low-cost, low-emission alternative to fossil fuels.
5) It doesn't produce any negative impact.
6) According to data of July 2008, there were more than 430 operating nuclear power plants.
7) In the United States some states benefit more than others.
8) Power plants that depend on atomic energy don't operate that differently from a typical fuel burning power plant.
9) Coal burning power plant heats water into pressurized steam, which drives a turbine generator.
10) Nuclear plants depend on the heat that occurs during nuclear fusion.

68. Write a summary of Text B.

69. Match the Russian and English equivalents.

a)	to flicker through one’s mind	1) извлекать пользы больше остальных
b)	concrete coolant towers	2) главное отличие
c)	torrents of steam	3) грибовидное облако

d)	a mushroom cloud	4) грандиозная энергия
e)	to praise the technology	5) промелькнуть в голове
f)	to benefit more than others	6) пар под давлением
g)	cosmic energy	7) потоки пара
h)	pressurized steam	8) турбогенератор
i)	the key difference	9) превозносить технологию
j)	a turbine generator	10) бетонные охладительные башни

70. Translate the text into Russian in written form paying attention to active vocabulary.

What is a Difference Between Atomic and Nuclear Energy?

Nuclear energy or atomic energy is the type of energy that comes from the nuclei of atoms. Both protons (positive electric charge) and neutrons (neutral) are found in the nucleus of an atom. The nucleus contains most of the mass of an atom, Energy is released any time there is a change in an atom's nucleus.

But "atomic energy" is really a misnomer for nuclear energy. It is the fission of the nucleus which causes energy to be released. At the atomic level we are dealing with chemical reactions, but in the early days people did talk of atomic power and atomic bombs.

71. Answer the following question and read the text below to check your answer.

How many tons of wastes does a nuclear power plant generate per year?

Text C. Pros and cons of nuclear power plants

Whether you view nuclear power as the promise for a better tomorrow or a whopping down payment on a mutant filled apocalypse, there's a good chance you won't be easily converted to the other side. After all, nuclear power boasts a number of advantages, as well as its share of downright depressing negatives.

As far as positives go, nuclear power's biggest advantages are tied to the simple fact that it doesn't depend on fossil fuels. Coal and natural gas power plants emit carbon dioxide into the atmosphere, contributing to climate change. With nuclear power plants, CO2, emissions are minimal.

According to the Nuclear Energy Institute, the power produced by the world's nuclear plants would normally produce 2 billon metric tons of CO_2 per year if they depended on fossil fuels. In fact, a properly functioning nuclear power plant actually releases less radioactivity into the atmosphere than a coal fired power plant. By not depending on fossil fuels, the cost of nuclear power also isn't affected by fluctuations in oil and gas prices.

As for negatives, nuclear fuel may not produce CO2 but it does provide its share of problems. Historically, mining and purifying uranium hasn't been a very clean process. Even transporting nuclear fuel to and from plants poses a contamination risk. And once the fuel is spent, you can't just throw it in the city dump. It's still radioactive and potentially deadly.

On average, a nuclear power plant annually generates 20 metric tons of used nuclear fuel, classified as high–level radioactive waste. When you take into account every nuclear plant on the Earth, the combined total climbs to roughly 2,000 metric tons yearly.

All of this waste emits radiation and heat, meaning that it will eventually corrode any container and can prove lethal to nearby life forms. As if this weren't bad enough, nuclear power plants produce a great deal of low-level radioactive waste in the form of radiated parts and equipment.

Eventually spent nuclear fuel will decay to safe radioactive levels, but it takes tens of thousands of years. Even low-level radioactive waste requires centuries to reach acceptable levels. Currently, the nuclear industry lets waste cool for years before mixing it with glass and storing it in massive cooled, concrete structures. In the future, much of this waste may be transported deep underground. In the meantime, however, this waste has to be maintained, monitored and guarded to prevent the materials from falling into the wrong hands. All of these services and added materials cost money – on top of the high costs required to build a plant.

Nuclear waste can pose a problem, and it's the result of properly functioning nuclear power plants. When something goes wrong, the situation can turn catastrophic. The Chernobyl disaster is a good recent example. In 1986 the Ukrainian nuclear reactor exploded, spewing 50 tons of radioactive material into the surrounding area, contaminating millions of acres of forest. The disaster forced the evacuation of at least 30,000 people, and eventually caused thousands to die from cancer and other illnesses.

Active vocabulary

Try to memorize the following words and phrases.

city dump	городская свалка
to contribute	внести свой вклад
to pose	представлять
to purify	очистить
to guard	охранять
lethal	летальный

72. Decide whether the following statements are true or false according lo the text.

1) A coal– fired power plant discharges less radioactivity into the atmosphere than a nuclear power plant.
2) There is always a contamination risk while transporting nuclear fuel to and from plants.
3) Nuclear power depends on fossil fuels.
4) Coal and natural gas power plants contribute to climate change.
3) A nuclear power plant generates high– level radioactive waste.
5) It takes tens of years for spent nuclear fuel to decay to safe radioactive levels.
6) Now the nuclear industry mixes wastes with glass and cool them for years.

73. Answer the following questions and give examples.

1) Are CO_2 emissions minimal or maximal from nuclear power plants? Why? Why not?
2) What isn't the cost of nuclear power affected by?
3) What problems does nuclear fuel produce?
4) Does nuclear power have a number of drawbacks? Why? Why not?
5) Why can't we throw nuclear fuel after it has been spent?
6) What do radioactive wastes emit?
7) How many years does low-level radioactive waste require to reach acceptable levels?
8) How are nuclear wastes stored?
9) What has to be done to radioactive wastes?

74. Find key words and phrases which best express the general meaning of each paragraph.

75. Write a summary of Text C.

76. Put the statements into the correct column. Analyze the advantages and disadvantages of nuclear power.

Advantages	Disadvantages

1) Nuclear power costs about the same as coal, so it's not expensive to make.
2) Although not much waste is produced, it is very, very dangerous.

3) It must be sealed up and buried for many years to allow the radioactivity to die away.

4) Produces small amounts of waste.

5) Nuclear power is reliable.

6) Does not produce smoke or carbon dioxide, so it does not contribute to the greenhouse effect.

7) Nuclear power is reliable, but a lot of money has to be spent on safety– if it does go wrong, a nuclear accident can be a major disaster.

8) Produces huge amounts of energy from small amounts of fuel.

9) People are increasingly concerned about this – in the 1990's nuclear power was the fastest growing source of power in much of the world. In 2005 it's the second slowest growing.

4. RENEWABLE SOURCES OF ENERGY

1. Discuss in your group the prospects of nuclear power development in Russia. Find out additional information.

2. Answer the following questions and read the text below to check your answer.

1) What is the difference between renewable and non– renewable energy sources?
2) Why is it so important to develop alternative energy sources?

Text A. The pros and cons of alternative energy

Oil and oil products make the world go round, some would say. Just about every piece of equipment or type of machinery uses oil to run. Oil, however, is a «non-replenishable» resource, and when it runs out, how will we run our equipment and machinery? In response to this question, many are trying to develop alternative sources of energy. Hopefully, these alternative sources will make the world less dependent on the limited supply of oil.

There are a number of types of alternative energy sources which have already been developed. They include:

Energy from the sun. Known as solar energy, this powerful and unlimited source of energy would offer us a very efficient alternative to oil, and it is a free resource.

If solar power were properly developed, it could easily become our primary power source. The use of solar power is especially attractive in areas that have long days and not much cloud cover. It is therefore ideal for less developed areas which may be far from the more traditional power sources.

The problem is that capitalizing on this powerful resource is not as simple as it seems. Locations with limited daylight hours or consistently overcast skies do

not receive the amount of light required to store the energy, in addition, locations that do not have wide expanses of land available will not be able to tap this resource, since the photocells necessary to collect and store the sunlight require large tracts of land.

Wind. The power of the wind was harnessed hundreds of years ago to run windmills, which directly ran mills on farmlands. The same principle can now be used, with the addition of storage capacity, to supply as much as 20 % of our energy needs. In locations with strong winds, such as along the seashore, or in the mountains, wind can easily be harnessed to run generators to create electricity. This is an energy alternative that is safe and clean: no harmful carbon dioxide or other gases are produced in the creation of electricity through wind power. However, there are many areas that don't receive enough wind to make it a reliable source.

Hydroelectric energy. A powerful surge of water sluicing over a cliff creates a tremendous source of energy. This is the concept behind the construction of the many dams in the world today. Hydroelectric energy is another clean alternative to oil, since it does not produce waste or pollution. Energy produced by a dam is cheap and adaptable, but the cost of building a dam is very high and, without destroying entire potentially habitable areas, it is difficult to find locations for dams. Tidal energy – the power of water can also be harnessed on a smaller scale by the use of tidal flow. This alternative is very limited, however, since not every area has bodies of water with strong tidal flows, and the concern over the effect on fish and birds in the area raise many concerns. It is also not a steady source of energy, since tides move in twice daily movements. For this reason there are only nine workable sites for this type of power and only two being used.

Biomass. Biomass can be considered a nice way of speaking of waste. Animal waste, rotten crops and grains, residues from wood mills and aquatic waste can all be fermented to form an alcohol that is comparable to coal in its energy producing powers. It also produces greenhouse gases, making it one of the less attractive alternative energy sources. In addition to these more «natural» sources of energy production, fusion, fuel cells, nuclear, geothermal and hydrogen energies can be used for our future needs for power. These have negative environmental effects and so are questioned as alternative sources, but doesn't oil have as many, if not more negative effects?

Active vocabulary

Try to memorize the following words and phrases.

photocell	фотоэлемент
surge of water	всплеск воды
concern	беспокойство

to run out	выбежать
to capitalize	извлечь выгоду
to tap a resource	задействовать ресурс
to sluice	промывать
overcast	облачный
non– replenishable	невосполнимый
adaptable	приспосабливающийся
habitable	обитаемый
properly	правильно

3. Choose the right option.

Renewable energy sources

1) I am heat energy from inside the Earth. I heat underground rocks and water. Sometimes I am buried too deep to use. I am clean energy.

a) Biomass

b) Geothermal

c) Wind

2) I am the energy in things that used to be alive. My energy is stored in trees, plants, and garbage. You can burn me to make heat and electricity. I can pollute the air when I am burned.

a) Petroleum

b) Biomass

c) Wind

3) I am the energy in moving water. Dams can harness my energy. My power can make electricity. I am clean, cheap energy.

a) Wind

b) Hydropower

c) Natural gas

4) I am the energy in moving air. Some places have a lot of me, others only a little. Machines with blades capture my energy, turning it into electricity. I don't pollute the air, but cause noise pollution.

a) Nuclear power

b) Wind

c) Solar Energy

5) I make plants grow and I give you light. I make the wind blow and the rain fall. Today, it costs a lot to harness my energy. Photovoltaic cells can turn my energy into electricity.

a) Solar Energy

b) Water

c) Geothermal

Nonrenewable energy sources

2) I look like a shiny black rock. I am a fossil fuel that is buried underground. I am often transported by river barges. I can pollute the air when I am burned to make electricity.

a) Coal

b) Solar Energy

c) Biomass

3) I am a gas with no color, no taste and no smell. Companies give me a funny smell so that you can tell if I escape. Companies drill wells to pump me from the ground. I am the cleanest fossil fuel.

a) Petroleum

b) Oxygen

c) Natural gas

3) People drill wells to pump me from the ground and under the ocean. I am made into lots of things, like gasoline and plastics. I make more energy than any other energy source. I am a fossil fuel that pollutes the air when I am burned.

a) Petroleum

b) Geothermal

c) Coal

4) My energy is used to make electricity. I am used to make nuclear power. My energy does not pollute the air. My waste is radioactive and can be dangerous.

a) Uranium

b) Wind

c) Solar energy

5) I am used in farms and in backyard grills. I am portable and can be shipped in tanks and bottles. I am a fossil fuel that is buried underground. I am clean burning.

a) Biomass

b) Coal

c) Propane

4. Translate the following sentences from Russian into English.

1) Соответственно, необходимо более пристально рассмотреть возможность использования альтернативных источников энергии, таких как солнце, ветер, вода и т.д.

2) Все источники энергии могут подразделяться на возобновляемые и невозобновляемые.

3) Основным недостатком ископаемых видов топлива являются

вредное воздействие на окружающую среду и то, что они быстрее иссякают, чем возобновляются.

5. Decide whether the following statements are true or false according to the text.

1) The use of solar power is especially attractive in areas with limited daylight hours or consistently overcast skies.
2) The power of the wind has been developed recently.
3) Carbon dioxide or other gases can be produced in the creation of electricity through wind power.
4) Almost every piece of equipment or type of machinery uses gas to run.
6) There are few types of alternative energy sources which have already been developed.
7) Solar energy is a powerful and unlimited source of energy and it is a free resource.
8) Hydroelectric energy doesn't generate waste or pollution.
9) Energy produced by a dam is expensive and adaptable, but the cost of dam construction is very cheap.
10) There are only nine workable sites for tidal power and only two are in use.
11) Because of greenhouse gases, biomass is one of the less attractive alternative energy sources.

6. Answer the following questions.

1) What is the concept behind the construction of the many dams in the world today?
2) What are the pros and cons of tidal energy?
3) What wastes can be fermented to form an alcohol?
4) What are the pros and cons of biomass?
5) What types of alternative energy sources have been developed yet?
6) Where is solar power especially attractive?
3) What is the main problem with capitalizing on solar power?
7) Where was the power of wind harnessed for the first time?
8) What types of landscape have strong winds?
9) Wind energy is safe and clean, isn't it? Prove it.
10) Why isn't wind power reliable in some areas?

7. What parts of the text can you define? Do they correspond to the paragraphs? Name each part.

1. _____ 4._____
2._____ 5._____
3._____ … _____

8. Find key words and phrases which best express the general meaning of each part.

9. Make an oral report on Text A.

10. Discuss with your groupmates or in pairs:

1) What are the advantages and disadvantages of alternative energy sources?
2) What are the prospects of alternative energy sources harnessing in different countries? (Find out additional information).

11. Read the following text and translate the words in brackets. Make an abstract of the text in 2 – 3 sentences.

In 2009 substantial investments were made to improve Belarus' *(возобновляемые источники)* capacity, with proposals including three hydroelectric plants, several *(биомасса)* and combined heat and power plants, plus the *(строительство)* of over 2.400 *(ветряки)*. Of all renewables, *(биотопливо)* is most *(привлекательны)* to Belarus because of the vast *(площадь)* of forest and farmland across the republic.

Biofuel facilities are being constructed in the southern towns of Mozyr and Bobruisk to *(производить)* 650 million litres of bio– ethanol a year, and *(химический)* company Azot is experimenting with the production of methyl ether from rape oil.

Biomass also offers ways to *(восстанавливать)* land *(загрязненный)* by the Chernobyl disaster as the growing and harvesting process helps *(очистка)* the land.

12. ***Read the text below.***

Text B. How solar energy works

Solar energy – power from the sun – is free and inexhaustible. This vast, clean energy resource represents a viable alternative to the fossil fuels that currently pollute our air and water, threaten our public health, and contribute to

global warming. Failing to take advantage of such a widely available and low-impact resource would be a grave injustice to our children and all future generations.

In the broadest sense, solar energy supports all life on Earth and is the basis for almost every form of energy we use. The sun makes plants grow, which can be burned as «biomass» fuel or, if left to rot in swamps and compressed underground for millions of years, in the form of coal and oil. Heat from the sun causes temperature differences between areas, producing wind that can power turbines. Water evaporates because of the sun, falls on high elevations, and rushes down to the sea, spinning hydroelectric turbines as it passes. But solar energy usually refers to ways the sun's energy can be used to directly generate heat, lighting, and electricity

The solar resource. The amount of energy from the sun that falls on Earth's surface is enormous. All the energy stored in Earth's reserves of coal, oil, and natural gas is matched by the energy from just 20 days of sunshine. Outside Earth's atmosphere, the sun's energy contains about 1,300 watts per square meter. About one third of this light is reflected back into space, and some is absorbed by the atmosphere (in part causing winds to blow).

By the time it reaches Earth's surface, the energy in sunlight has fallen to about 1,000 watts per square meter at noon on a cloudless day. Averaged over the entire surface of the planet, 24 hours per day for a year, each square meter collects the approximate energy equivalent of almost a barrel of oil each year, or 4,2 kilowatt hours of energy every day.

This figure varies by location and weather patterns. Deserts, with very dry air and little cloud cover, receive the most sun more than six kilowatt hours per day per square meter. Northern climes get closer lo 3.6 kilowatt hours.

Passive solar design for buildings. One simple, obvious use of sunlight is to light our buildings. If properly designed, buildings can capture the sun's heat in the winter and minimize it in the summer, while using daylight year round. Buildings designed in such a way are utilizing passive solar energy a resource that can be tapped without mechanical means to help heat, cool, or light a building. South facing windows, skylights, awnings, and shade trees with the sun in mind can be comfortable and beautiful places to live and work.

Solar heat collectors. Besides using design features to maximize their use of the sun, some buildings have systems that actively gather and store solar energy. Solar collectors, for example, sit on the rooftops of buildings to collect solar energy for space heating, water heating, and space cooling. Most are large, flat boxes painted black on the inside and covered with glass. In the most common design, pipes in the box carry liquids that transfer the heat from the box into the building.

This heated liquid usually a water alcohol mixture to prevent freezing is used to heat water in a tank or is passed through radiators that heat the air. Oddly enough, solar heat can also power a cooling system. Today, about 1,5 million U.S. homes and businesses use solar water heaters. In other countries, solar collectors are much more common; Israel requires all new homes and apartments to use solar water heating, and 92 percent of the existing homes in Cyprus already have solar water heaters. With natural gas prices at historically high levels, solar water and space heaters have become much more economic.

The future of solar energy. Solar energy technologies poised for significant growth in the 21st century. More and more architects and contractors are recognizing the value of passive solar and learning how to effectively incorporate it into building designs. Solar hot water systems can compete economically conventional systems in some areas. And as the cost of solar PV continues to decline, these systems will penetrate increasingly larger markets. In fact, the solar PV industry aims to provide all new U.S. electricity generation by 2025.

Aggressive financial incentives in Germany and Japan have made these countries global leaders in solar deployment for years (source: www.ecoenergysc.com)

Active vocabulary

Try to memorize the following words and phrases.

elevation	высота
injustice	несправедливость
to evaporate	испаряться
to capture	захватить
to spin	вращаться
to absorb	поглощать
to rot	гнить
to penetrate	проникать
inexhaustible	неисчерпаемый
viable	жизнеспособный
low– impact	с низкой отдачей

13. Read the following international words.

basis	atmosphere	to minimize
turbine	meter	radiator
hydroelectric	to absorb	percent
to generate	equivalent	financial

14. Decide whether the sentences are true or false according to the text.

1) The sun's energy contains about 1,500 watts per square meter outside Earth's atmosphere.

2) The sun's energy reduces to about 1,000 watts per square meter at noon on a cloudy day.

3) Each square meter collects the energy equivalent of 5,2 kilowatt– hours of energy every day.

4) Skylights, south – facing windows are the examples of passive solar energy.

5) Solar collectors are installed on the roofs of buildings to accumulate solar energy for heating.

6) Energy from the sun is the basis for almost every form of energy we use.

7) Solar energy occurs as a result of temperature differences between areas.

8) Solar energy is considered to be the ways the sun energy is used to directly generate heat.

9) Solar collectors use a water – alcohol mixture to prevent drying up.

10) About 1,5 million German homes and enterprises use solar water heaters currently.

11) Solar hot water systems have become a good alternative to conventional systems in some areas.

12) The purpose of the solar PV industry is to provide half of all new U.S. electricity generation by 2035.

15. Answer the following questions and give examples.

1) How many watts per square meter does the sun's energy contain?
2) How much energy on average does square meter collect for a year?
3) How does this figure vary?
4) What are the main advantages of solar energy?
5) What does solar energy contribute to?
6) What is an obvious use of sunlight for buildings?
7) What are the systems that gather and store solar energy?
8) What countries with active harnessing of solar power for buildings do you know?
9) What are the prospects of solar energy technologies in the nearest future?
10) What countries are leaders in solar deployment?

16. Find key words and phrases which best express the general meaning of each paragraph.

17. Write a summary of Text B.

18. Discuss with your groupmates or in pairs:

1) What is the main problem with solar panels usage in Russia?
2) Is it possible to use energy from the sun for industrial purposes in our Republic? Why? Why not?

20. Match the appropriate derivatives and translate them into Russian.

1)	to exhaust	a) injustice
2)	current	b) vapor
3)	to justify	c) south – facing
4)	to evaporate	d) to affect
5)	cloudy	e) currently
6)	sunlight	f) inexhaustible
7)	equivalent	g) atmosphere
8)	sphere	h) cloudless
9)	to localize	i) requirement
10)	to face	j) sunny
11)	to require	k) equal
12)	effectively	l) location

21. Translate the following words and phrases into English using the vocabulary of the text.

При надлежащем проектировании, активно накапливать и сохранять, нагретая жидкость, водно– спиртовой раствор, предотвращать замораживание, значительный рост, энергия солнца, жизнеспособная альтернатива, широко доступный, воспользоваться преимуществом, большое упущение (несправедливость), в наиболее широком смысле, разница в температурном режиме, производить непосредственно, поверхность Земли, расположение и синоптическая ситуация, осознавать ценность, традиционные системы.

22. Read and translate into Russian the manual for the solar panel battery.

How does the solar power system work? The panel converts the Sun's energy into a direct current (DC) electric current. The current flows to the controller. Then it can flow from the controller to the lamps. Or it can flow from the controller into the battery. The battery stores the electricity. The current can flow from the battery into the lamps through the controller.

If the Sun shines, the DC current can flow from the panel, through the controller and into the lamps. If the Sun doesn't shine, the current can flow from the battery, through the controller and into the lamps. If the lamps are off, the current can flow from the panel, through the controller, and into the battery.

The controller controls the flow of the current. If the battery is full, the controller stops the flow from the panel into the battery. If the battery is empty, the controller stops the flow from the battery into the lamps.

d) Identify the equipment from the description. There are two extra words.

a) controller c) cable e) electrical current
b) solar panel d) battery f) radiator

1) It converts energy from the Sun into electricity.
2) It stores the electricity.
3) It controls the flow of the current.
4) It flows from the panel, through the controller and into the lamps.

Text C. Solar cells

In a sunny climate, you can get enough power to run a 100W light bulb from just one square meter of solar panel. This was originally developed in order to provide electricity for satellites, but these days many of us own calculators powered by solar cells. People are increasingly installing PV panels on their roofs. This costs thousands of pounds, but if you have a south– facing roof it can help with your electricity bills quite a bit, and the government pays you for any extra energy you produce and feed back into the National Grid (called the "feed in tariff").

1. But what do solar panels cost?
2. How much might they generate for you?
3. What's the "payback time" until the money you've saved on bills is more than the cost of installation?

Solar water heating, where heat from the Sun is used to heat water in glass panels on your roof. This means you don't need to use so much gas or electricity to heat your water at home. Water is pumped through pipes in the panel. The pipes are painted black, so they get hotter when the Sun shines on them. The water is pumped in at the bottom so that convection helps the flow of hot water out of the top.

This helps out your central heating system, and cuts your fuel bills. However, with the basic type of panel shown in the diagram you must drain the water out to stop the panels freezing in the winter. Some manufacturers have systems that do this automatically. Solar water heating is easily worthwhile in places like California and Australia, where you get lots of sunshine. Mind you, as technology improves it's becoming worthwhile in the UK.

This "Thermomax" panel is made of a set of glass tubes. Each contains a metal plate with a blue ash coating to help it absorb solar energy from IR to UV, so that even in diffuse sunlight you get a decent output. The air has been removed from the glass tubes to reduce heat loss, rather like a thermos flask.

Up the back of the metal plate is a "heat pipe", which looks like a copper rod but contains a liquid that transfers heat very quickly to the top of the glass tube. A water pipe runs across the top of the whole thing and picks up the heat from the tubes.

Solar boilers

The main way that a conventional gas "combination boiler" continually wastes energy is by replenishing stored water as soon as the volume or temperature decreases. With solar powered boilers, this is instead fuelled by the solar power collected through panels on the roof of your home. The power collected through the solar tiles is used to fuel and therefore heat a separate water cylinder, thus saving energy throughout the course of every day. Another smaller tank, still powered by gas, is provided with most solar boiler installations as a backup.

Solar furnaces use a huge array of mirrors to concentrate the Sun's energy into a small space and produce very high temperatures.

What is the principle of harnessing wind power?

Text D. Energy from wind

Wind is simple air in motion. It is caused by the uneven heating of the earth's surface by the sun. Since the earth's surface is made of very different types of land and water, it absorbs the sun’s heat at different rates.

During the day, the air above the land heats up more quickly than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds. At night, the windy are reversed because the air cools more rapidly over land than over water In the same way the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles.

Today, wind energy is mainly used to generate elecricity. Wind is called a renewable energy source because the wind will blow as long as the sun shines.

Since ancient times, people have harnessed the winds energy. Over 5,000 years ago, the ancient Egyptians used wind to sail ships on the Nile River. Later, people built windmills to grind wheat and other grains. The earliest known windmills were in Persia (Iran). These early windmills looked like large paddle wheels. Centuries later, the people of Holland improved the basic design of the windmill. They gave it propeller type blades, still made with sails. Holland is famous for its windmills.

American colonists used windmills to grind wheat and corn, to pump water, and to cut wood at sawmills. The oil shortages of the 1970s changed the energy

picture for the country and the world. It created an interest in alternative energy sources, paving the way for the reentry of the windmill to generate electricity.

Like old fashioned windmills, today's wind machines use blades to collect the wind's kinetic energy. Windmills work because they slow down the speed of the wind. The wind flows over the airfoil shaped blades causing lift, like the effect on airplane wings, causing them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.

With the new wind machines, there is still the problem of what to do when the wind isn't blowing. At those times, other types of power plants must be used to make electricity.

There are two types of wind machines (turbines) used today based on the direction of the rotating shaft (axis): horizontal axis wind machines and vertical axis wind machines. The size of wind machines varies widely. Small turbines used to power a single home or business may have a capacity of less than 100 kilowatts. Some large commercial sized turbines may have a capacity of 5 million watts, or 5 megawatts. Larger turbines are often grouped together into wind farms that provide power to the electrical grid.

Horizontal axis. Most wind machines being used today are horizontal axis type. Horizontal axis wind machines have blades like airplane propellers. A typical horizontal wind machine stands as tall as a 20 story building and has three blades that span 200 feet across. The largest wind machines in the world have blades longer than a football field! Wind machines stand tall and wide to capture more wind.

Vertical axis. Vertical axis wind machines have blades that go from top to bottom and the most common type looks like giant two– bladed egg beaters. The type of vertical wind machine typically stands 100 feet tall and 50 feel wide. Vertical axis wind machines make up only a very small percent of the wind machines used today.

Wind power plants, or wind farms as they are sometimes called, are clusters of wind machines used to produce electricity. A wind farm usually has dozens of wind machines scattered over large area. The world's largest wind farm, the Horse Hollow Wind Energy Center in Texas, has 421 wind turbines that generate enough electricity to power 220,000 homes per year.

Unlike power plants, many wind plants are not owned by public utility companies. Instead they are owned and operated by business people who sell the electricity produced on the wind farm to electric utilities. These private companies are known as Independent Power Producers.

Operating a wind power plant is not as simple as just building a windmill in a windy place. Wind plant owners must carefully plan where to locate their

machines. One important thing to consider is how fast and how much the wind blows.

As a rule, wind speed increases with altitude and over open areas with no windbreaks. Good sites for wind plants are the tops of smooth, rounded hills, open plains or shorelines, and mountain gaps that produce wind tunneling.

Wind speed varies throughout the country. It also varies from season to season.

New technologies have decreased the cost of producing electricity from wind, and growth in wind power has been encouraged by tax breaks for renewable energy and green pricing programs. Many utilities around the country offer green pricing options that allow customers the choice to pay more for electricity that comes from renewable sources.

Most of the wind power plants in the world are located in Europe and in the United States where government programs have helped support wind power development. The United States ranks second in the world in wind power capacity, behind Germany and ahead of Spain and India. Denmark ranks number six in the world in wind power capacity but generates 20 percent of its electricity from wind.

In the 1970s, oil shortages pushed the development of alternative energy sources. In the 1990s, the push came from a renewed concern for the environment in response to scientific studies indicating potential changes to the global climate if the use of fossil fuels continues to increase. Wind energy is an economical power resource in many areas of the country. Wind is a clean fuel; wind farms produce no air or water pollution because no fuel is burned. Growing concern about emissions from fossil fuel generation, increased government support, and higher costs for fossil fuels (especially natural gas and coal) have helped wind power capacity grow substantially over the last 10 years.

The most serious environmental drawbacks to wind machines may be their negative effect on wild bird populations and the visual impact on the landscape. To some, the glistening blades of windmills on the horizon are an eyesore; to others, they're a beautiful alternative to conventional power plants.

Active vocabulary

Try to memorize the following words and phrases.

windmill	ветряная мельница
paddle wheel	лопастное колесо
shaft	вал
sawmill	лесопилка
airfoil	аэродинамический
cluster	кластер

altitude	высота
tax break	налоговая льгота
propeller– type blades	лопасти крыльчатой формы
sail	плыть
axis	ось
wind tunneling	ветер туннелирования
wind farm	ветровая электростанция
electrical grid	электросеть
public utility company	коммунальное предприятие
green pricing program	программа экологичного ценообразования
to rush	спешить
to cause	вызывать
to reverse	отменить
to scatter	разбрасывать
to rotate	вращаться
to capture	захватить
to span	охватить, крутить

23. Put the following sentences in the correct order according to the text.

1) The large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles.

2) ___ There are horizontal– axis and vertical– axis wind machines.

3) ___Wind power plants are clusters of wind machines used to produce electricity.

4) ___Wind is caused by the uneven heating of the earth's face by the sun.

5) ___Like old fashioned windmills, today's wind machines use blades to collect the wind's kinetic energy.

6) A typical horizontal wind machine stands as tall as a 20-story building and has three blades that span 200 feet across.

7) Over 5,000 years ago, the ancient Egyptians used wind to sail ships on the Nile River.

8) ____ Government programs adopted in Europe and in the US support wind power development.

9) ___Vertical– axis wind machines have blades that go from top to bottom and usually look like a giant two– bladed egg beaters.

10) ___Wind plants may be owned by public utility companies or business people.

11) ___New technologies have decreased the cost of producing electricity from wind, and growth in wind power has been encouraged by tax breaks for renewable energy and green pricing programs.

12) ___ Potential changes to the global climate pushed the development of alternative energy sources in the 1990s.

e) Make the following statements true according to the text.

1) The blades are joined to a drive shaft that turns a windmill to produce electricity.

2) Small turbines may have a capacity of more than 100 kilowatts and some large turbines may have a capability of *5* megawatts.

3) The most popular wind machines are vertical axis.

4) Many wind plants as well as power plants are not owned by public utility companies.

5) Operating a wind power plant is easier than just building a windmill in a windy place.

6) The air above the water heats up more quickly than the air over land during the day.

7) Contrary the air cools more slowly over land than over water and the winds are reversed at night.

8) The earliest known windmills were in Holland.

9) American colonists created an interest in alternative energy sources.

10) Wind speed remains constant throughout the country but it varies from season to season.

11) The cost of producing electricity from wind has been increased by new technologies.

12) The negative effect on wild bird populations and the visual impact on the landscape are the most serious environmental advantages of wind machines.

f) Answer the following questions and give examples.

1) What changed the energy picture for the world in the 1970s?
2) How do windmills work?
3) Why does the earth's surface absorb the sun's heat at different rates?
4) What is the problem with the new wind machines? What is the solution?
5) What are wind machines based on?
6) What are wind farms?
7) How did the early windmills look like?
8) Who improved the basic design of the windmill later?

9) What is the difference between the horizontal - axis and vertical - axis wind machines?
10) The world's largest wind farm is located in Texas, isn't it?
11) Who owns wind plants?
12) What sites are suitable for wind plants?
13) What has helped wind power capacity grow substantially over the last 10 years?
14) What are the advantages of wind energy?
15) What are the disadvantages of wind machines?

g) Write a summary of Text D.

h) Discuss with your groupmates or in pairs:

What are the main problems with wind power usage in Russia? Is it possible to use energy from the wind for industrial purposes in our country? Why? Why not? What European countries actively utilize wind energy? Give examples. (Find out additional information).

i) Fill in the gaps with the words from the text.

1) Wind farms are considered to be ... of wind machines used to produce ...
2) The types of wind machines are based on the direction of rotating ...
3) Many power plants are ... by business people who sell the electricity from the wind farm to ...
4) Good sites for wind plants are the tops of... hills and mountain...
5) Wind speed increases with ...
6) Many utilities around the U.S. offer ... to the customer to support alternative
7) Germany ... first in the world in wind power ...
8) The most serious environmental ... to the wind machines are their negative effect on ...

j) Find the defined words in the text.

1) The height of an object or structure above a reference level, usually above sea level or the Earth's surface.

2) A fence or a line of trees that gives protection from the wind by breaking its force.

3) A company that performs a public service; subject to government regulation.

4) Energy or a substance given out by something.

5) A tax deduction that is granted in order to encourage a particular type of commercial activity.

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