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NATURAL RESOURCES OF THE FUTURE

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Abstract

The paper examines the problems of replacing non-renewable resources with inexhaustible and renewable resources, ie future resources. The issue is discussed in a complex way and by individual species of resources. Particular attention is paid to space resources - the use of the resources of asteroids, the Moon, Mars and Jupiter.
Keywords: *Natural Resources of the Future, Renewable Resources, Asteroid Resources, Moon Resources, Mars Resources*

JEL Classification: …………...

Statement of the problem in general outlook and its connection with important scientific and practical tasks

Many resources on Earth are already scarce and in the future this could have total catastrophic consequences for humanity. The earth contains a limited amount of natural resources, this limitation is felt over time with the change in the scale of production. For example, in a pre-industrialized society, resource constraints were not felt. It becomes noticeable as the production volume increases due to the introduction of new technologies. The growth of the population also plays an important role in this process, because with the growth of the population, the amount of resources consumed also increases. At the modern stage, humanity is facing the need to search for resources of the future, because in the not-too-distant future, many of the earth's natural resources will be depleted (for example, non-renewable resources such as oil, coal, natural gas, metals, etc.).

The natural resources of the future can be viewed as renewable resources of the Earth, and resources that are still not exploited or are practically inexhaustible. Therefore, the resources of the future, in addition to renewable resources, include the resources of the oceans and seas, as they are still untapped and practically inexhaustible. The resources of the future also include space resources that are not renewable, but not exploited and inexhaustible. So far, the world does not have the necessary technical means for the economically viable use of space resources, although intensive work is underway to use them [Glazyev, 2016].

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The Earth's renewable natural resources are: solar radiation; Water and wind energy; Air and water space; Climatic; Geothermal; Biological (animal, plant and household origin); The difference in temperature between the atmosphere and the oceans; The energy of the waves, currents, tides, and tides of the oceans and seas; Sea water temperature gradient energy.
In general, such a division is conditional, since the renewable resource may also eventually run out (for example, solar energy and related types of energy - wind and water energy, etc.), And some of the resources that were considered non-renewable become renewable through modern technologies. For example, an iron resource can be considered as a partially renewable resource as a result of the use of its substitutes and the re-use of products made from it. That is why great importance is attached to the "circular" economy.
Renewable [Abesadze, 2019; Twidell, 2016] and inexhaustible resources of the earth
From the renewable energy sources, the most important are hydropower Resources. People have been using water energy through water wheels since time immemorial. ater mills are preserved to this day almost intact. The energy base of manufacturing was water energy. In the early 19th century, steam engines narrowed the water wheel, but after the discovery of long-distance transmission of electricity, water engines still regained their lost value due to the invention of hydroturbines.
The sun - a giant thermonuclear reactor - is the source of life on Earth, as it provides the necessary conditions for human existence in all major areas, including providing humanity with virtually all types of energy. This is a huge source of energy with a capacity of 4.1023 kW, of which only a small part falls on the ground - 1014 kW. On average, one kilowatt of solar energy falls per square meter of illuminated Earth, but this figure is ten times higher than the amount of explored mineral fuels and a thousand times more than current world consumption. The best conditions for the use of solar energy exist in the arid zone (USA: Florida, California; Japan; Israel; Australia; Ukraine; (Crimea); Caucasus; Central Asia), where the duration of sunshine is the longest. Solar energy can be used to generate both heat and electricity. The world's first helio device appeared on January 6, 1952. Since then, thousands of helium devices have been invented: from the simplest boilers to huge (several thousand square meters) concentrates of parabolic mirrors (in focus at temperatures ranging from 2500 to 3500 ° C) to solar tower-type power plants with a capacity of several decimal MW. Leading the world in terms of solar energy use: Germany, Italy, USA, China, Japan, in terms of solar concentrates - Spain, USA, Algeria, Egypt, Morocco, Australia [Solar…, 2010].
Wind energy plays an important role in the overall balance of the world's natural resources. Wind energy has been used since ancient times. At first it was used in navigation, and then instead of human muscle strength. For the first time, the simplest wind engine was built in Egypt and China. Remnants of windmills are still preserved in Egypt. Since the 18th century, wind turbines have been widely used in Western Europe to extract water, grind seeds, and drive various machines. Today, wind energy is also used to generate electricity. High-capacity wind farms with a vertical axis are becoming increasingly promising. The installed capacity of wind farms in the world is gradually increasing. The largest wind turbine in the world, located in Hawaii, is the height of a 20-storey building and its wingspan is the size of a standard football stadium. Today, Denmark is one of the most successful countries in the use of wind energy, where almost 50% of electricity is generated from wind energy. The most favorable places for wind energy are the coast of the North, Baltic and Arctic seas; Northern Siberia; Far East; South of the European part of Russia; Ukraine. World leaders in the use of wind energy are - China, USA, Germany, Spain, India.
Geothermal energy is the energy in the heart of the earth. The heart of the earth is a molten mass, its radiance exceeds even the radiance of the sun, this radiance and energy erupts on the surface of the earth in the form of volcanoes and geysers. The use of this energy, in addition to arranging baths, became possible for other purposes as well. 10% of the world's energy comes from geothermal energy, which is commonly used for heating and electricity generation. Iceland, where winter conditions are harsh, with stagnant soil and fiery water, 87% of the country's heat and 25%

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of its electricity come from geothermal energy. Geothermal energy is currently used in about 25 countries around the world, including: Iceland; Italy; France; Hungary; Japan; USA, New Zealand; Kamchatka; North Caucasus (with low-temperature thermal waters); Italy; USA (California), Mexico, New Zealand; Russia (Kamchatka).

The energy of the ebb and flow, currents and waves of the oceans and seas drives turbines, generators, and electricity is generated. The energy of the waves does not depend on the weather. Additional benefits for the population are bridges and roads that are created to arrange the station. France, England, Canada and Russia have good potential for ebb and flow energy production. Since this method of generating power is still in its early stages of development, there are only two commercial power plants in the world, one in France and one in Canada, and one experimental station in Russia. Top locations to harness tidal energy are: Brittany (France); the coast of the English Channel; White Sea; South China; Bay of Fundy (US and Canadian coasts); Great Britain; Russia; Korea; India; Australia; Argentina, etc. For the energy of the current - Hawaii (USA); Nauru (Japan); Tahiti (France); Bali (Netherlands). For wave energy - Japan, Norway.

Humanity was the first to use exactly biomass for heating and cooking. A bonfire lit to scare animals was a practical use of biomass energy. In terms of the use of biomass energy in the world, the leaders are: the USA, Brazil, China, Germany and Sweden.

The seawater energy gradient is the most efficient cold heat source with the greatest potential. Water temperature varies in depth and surface and is constant throughout the year. Around the world this concept is used by a Hawaiian power plant.

Climate resources are renewable resources. They include: light, humidity, heat, atmospheric precipitation. These resources have a special impact on agriculture, hence they are also called agro-cultural resources [Climate…, 2001].

Land resources are also renewable resources. The Earth covers an area of 510 million square kilometers, of which 149 million square kilometers are terrestrial, 129-135 million square kilometers are economically useful land resources, or 85-86.5% of the land area. (20 sq. km. Occupies the Arctic and Antarctica), including arable land - 11, forest - 13, fields and pastures - 23, anthropogenic landscapes - 3, low-fertile land - 33%. In the world, on average, per capita comes 0.3 hectares of arable land. It is noteworthy that the area of agricultural land in the world is decreasing due to their use for construction purposes and degradation.

Plant and animal resources have a great importance to humans. There have always been millions of other living organisms along with humans on Earth, including warm-blooded animals, invertebrates, microorganisms, low and high plants. On the one hand, people used living organisms, on the other hand, they changed their habitat and played a role in the extinction of some of their species. Today, according to the current legislation, animals and plants have equal human rights to exist on earth and to preserve, even for the useless [Biological, …, 2011].

Resources of the future are also resources related to renewable resources: building materials, salt, drinking water, forest, air, agricultural resources and products (land, plants, pets and poultry, fruits, garden vegetables, etc.)

Recreational resources are the resources that meet the needs of people in the field of recreation and tourism. Its species are: natural (parks, beach, mountain landscape, water basins, natural-territorial complexes, etc.) and anthropogenic (museums, cultural monuments, holiday homes, etc.).

The seas and oceans account for 96.5% of the Earth's hydrosphere. You can find 75 elements in them. Therefore, there is a large reserve of minerals. They contain salt the most. The waters of the oceans and seas contain manganese, sulfur, bromine, gold, silver, copper, uranium and other, virtually all useful chemical elements and minerals. 1 cubic meter of water contains 37 tons of dissolved substance. They possess energetical resources together with chemical and hydrological. Fuel gases- hydrogen sulfide, methane and propane are dissolved in sea water, the total amount of which is very large. Various methods of hydrogen sulfide production from sea water have been developed in the world, but so far none of them is perfect. One third of the world's oil and gas

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reserves are located on the shelf of the World Ocean. Currently, the most active production is in the Mexican, Guinean, Gulfs and the North Sea. The shelf of the oceans is rich in building materials (sand, gravel, limestone, etc.). The deep plains of the ocean are rich in iron-manganese concretion. Oceans and seas are also rich in bioresources, inhabited by 140,000 species of animal organisms, which are divided into three groups: Plankton, small wandering organisms that can only be seen under microscopes are. Used for food, technical raw materials and medical purposes;
Nectons, actively floating organisms include fish, turtles, penguins, water snakes. Used for food;
Benthos, which live on the seabed, are used for food.
Individual countries are studying methods and legal norms for mining in the polar regions of the Earth (Arctic and Antarctica). UN published an information brochure - "Technologies for the use of the seabed". If in the twentieth century it was believed that working to obtain resources on the seabed was as difficult as working on the moon, today such work is already underway successfully. Nuclear energy is used to generate electricity in nuclear power plants (NPPs), as well as in nuclear submarines and nuclear icebreakers, experiments are being carried out on the use of atomic energy on space satellites. In terms of the generated energy, they differ: a nuclear power plant that generates only electricity; A nuclear thermal power plant that generates both electrical and thermal energy; A nuclear power plant that generates only thermal energy. In the twentieth century, the use of atomic energy grew rapidly, but disasters around the world have led to a decrease in its consumption. But in the future, in security conditions, it is possible that its consumption will increase, since it is an almost inexhaustible source of energy.

Analysis of latest research where the solution of the problem was initiated

In USA the research ………….. text, text.
In Poland the research of nature and landscape of NNP was conducted by scholars such as R. Olaczek R. (Olaczek R., 2008), E. Symonides (Symonides E., 2008), G. Rakowski (Rakowski G., 2009), E. Kalbarczyk, K. Kasprzak R. Krajewski, B. Raszka (Kalbarczyk E., et al. 2016).

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Aims of paper. Methods

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Exposition of main material of research with complete substantiation of obtained scientific results. Discussion

The first steps in space exploration

The first artificial satellite, "Sputnik-1", was launched into space by the Soviet Union on October 4, 1957. Then, again by the Soviet Union, on April 12, 1961, a man, Yuri Gagarin, was first launched into space, after which manned spacecraft began to be launched into space. Remarkable, that on April 12, 1969, American astronauts Neil Armstrong and Base Aldrin first landed on the moon. On April 19, 1971, the Soviet station "Salut-1" was launched into Earth orbit, which gave rise to the long stay of humans in space and the conduct of a variety of scientific studies. The beginning was very difficult, many expeditions failed, so at first private companies could not take

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this risk. Currently, there are about 5,000 satellites orbiting the Earth, which provide a variety of services, and this is mainly done by private companies.
In recent years, a number of companies have expressed a desire to create technologies to extract resources in space. For example, the companies – "Planetary Resources" and "Deep Space Industries" (DSI) were the first to launch exploration probes with a mission to produce rocket fuel by 2025. DSI even plans to improve technology and extract metals directly from the asteroid. Company "Planetary Resources" aims to expand the extraction of natural resources of the Earth through the development and implementation of technologies for the extraction of asteroid resources. First of all, it concerns the creation of small, inexpensive space telescopes for the purpose of observing the Earth and asteroids. The spacecraft will use a laser-optical system to communicate with Earth. The company has already launched two experimental stations: Arkyd-3 (2015) and Arkyd-6 (2018). The first private space telescope - "Leo" has already been created. The company continues to work on the development of state-of-the-art technologies that will enable asteroids to extract both water and metals [Mikelsten…, 2019].

Cosmic natural resources

From the cosmic resources, the resources on celestial bodies (Moon, Mars, asteroids, meteors, etc.) are noteworthy.
In space it is possible to get metals, gas and water. The use of water is assumed when working on orbital stations, as well as for its separation into hydrogen and oxygen (fuel for reactors). And gases it is advisable to use on Earth. From metals in space can be found: titanium, nickel, iron, platinum, cobalt and others. Working in space due to low gravity is difficult and dangerous, however, the modern level of development of science and technology gives hope that in the not too distant future, this task will be successfully solved. Probably, robots will do the work in space, and unmanned vehicles will bring resources to Earth. Because of the distance, the newest celestial bodies will be assimilated first.
If earlier the launch of objects into space was associated with multibillion-dollar costs, today they are displayed only in millions and will be further reduced in the future.
Asteroid resources [Asteroid Resources. 2015]. Asteroids are the most economically attractive today. Most of the known asteroids are carbonaceous, class C, they contain water and thus are an excellent source of fuel for use in space, which will increase the time spent by the mission in space and will provide the opportunity to explore deep space. Other asteroids, class S and M, contain magnesium silicate and metal alloys (nickel, iron, manganese, precious metals), respectively, almost free of impurities.
The first can be used for construction in space, while the second can be used to gain resources. According to preliminary estimates, a typical M-class asteroid with a diameter of 1 km contains 30 million tons of nickel, 1.5 tons of cobalt, 7.5 tons of platinum (total value 150-200 billion dollars). The number of such asteroids in the solar system is about 3 million. Many of these are within reach and will pass close to Earth at certain intervals.
Asteroids possess a colossal amount of resources. A chondritic asteroid with a diameter of 7 meters contains 100 tons of water. A metal asteroid with a diameter of 24 meters contains 33,000 tons of metal. A single platinum-rich asteroid 500 meters wide contains 174 times more of this metal than is mined on Earth in one year. The asteroid (Psyche) contains 1.7-1010 kg of iron-nickel ore, which is a thousand times more than its reserves on Earth, and which has been used by mankind for several million years to build objects even in the case of increased consumption. On asteroids we can meet nitrogen, carbon dioxide, carbon dioxide, methane and others. Metals can be used directly to build space objects.
It should be noted that the resources in these space bodies are located evenly and not in their center as on Earth. This makes it easier to obtain them. Currently, the issue of extraction of rare metals is on the agenda.

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Asteroids are the original material left over after the formation of the solar system. Asteroids are scattered everywhere: a huge number of them are concentrated between Jupiter and Mars, forming the asteroid belt. They will also pass close to Earth's orbit, with more than 9,000 of them. In addition, there are 1,500 asteroids that are relatively easy to reach. The concentration of minerals on asteroids is much the same as on the richest deposits on Earth. Their use on Earth will greatly contribute to economic development and the improvement of human well-being.
Asteroids are small celestial bodies that revolve around the Sun, like the Earth. Due to their small size, they have a weak gravitational field. Extracting any kind of minerals from asteroids requires spaceships to get to them, as well as robotic equipment to get the job done.
Reaching the asteroid belt is possible and even has been executed by the Japanese "Haibusa-1", which submitted a sample to Earth. But these cosmic missions are still very important. Such devices are required: mass less as possible; Electricity supply from solar panels; High quality automation; Completion of work in practically unhealthy conditions. It is not difficult to transport metals on asteroids, but there is a danger of minerals and equipment coming off the surface. The cost of a device delivering a 50-gram sample from a nearby asteroid is $ 1 billion.
To reduce the cost of extracting raw materials from an asteroid, it is necessary: Implementation of technologies for the use of resources directly at the extraction site; For example, obtaining hydrogen and oxygen from water through solar panels and returning the apparatus with the resulting fuel. In the case of a manned device, the crew will also use hydrogen and oxygen; Manufacturing of products on asteroids by robots; Reducing the cost of rocket engines, etc.
The first asteroid that a NASA spacecraft landed on was „433 Eros". In 2000, the spacecraft left the asteroid and returned to Earth in 2001. In 2000, the Japanese "Hayabusa" landed on the asteroid "25143 itokava", but the device did not intervene. NASA mission „OSIRIS-Rex" traveled to near-Earth asteroid „Bennu" in 2016 and will return a small sample to Earth in 2023.
Moon resources. Initially, the only method of studying the moon was by visual observation of it. The first lunar satellite, Luna-3, was launched by the Soviet Union in 1959, which laid the foundation for its assimilation. Subsequent expeditions brought 324 grams of lunar soil to Earth by the Soviet Union and 380 grams of lunar soil by the United States. After that, private companies start studying the moon.
In 1969, the United States made the first manned landing on a satellite (followed by five manned flights to the moon in 1969, 1971, and 1972) [A brief…, 2017].
Subsequent expeditions brought 324 grams of lunar soil to Earth by the Soviet Union and 380 grams of lunar soil by the United States. After that, private companies start studying the moon.
The moon can become the primary source of space resources. Found on the moon: oxygen, silicon, iron, titanium, aluminum, manganese, calcium, chromium, silver, mercury, virtually all elements of Mendeleev's table.
It can also be used for refueling for backtracking. In many places there are surfaces with high titanium content. Lunar soil contains building materials, from which we can get: concrete, glass, ceramics, etc. One of the most important resources of the moon is water ice, which will help to settle on the moon and produce rocket fuel.
The moon can be used to: explore Earth and near space; To observe the dynamics of climate on Earth; To explore natural resources; To observe planets close to Earth; To facilitate spacecraft navigation; To assimilate the raw materials and energy resources available on it. The moon can become the primary source of space resources. On the moon are found: oxygen, silicon, iron, titanium, aluminum, manganese, calcium, chromium, silver, mercury, virtually all elements of Mendeleev's table.
The basis of energy on the Moon is solar energy (the moon has the best conditions for the use of solar energy, due to the lack of atmosphere), in the form of solar power plants. Electricity generated on the moon will be transmitted to the earth using laser technology.

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At the best quarry with a capacity of 105 m3 it is possible to extract 40,000 tons of silicon and 9,000 titanium. Hydrogen and oxygen can be obtained. Helium and other gases.
In many places there are surfaces with high titanium content. Lunar soil contains building materials, from which we can get: concrete, glass, ceramics, etc.
One of the most important resources of the moon is water ice, which will help to settle on the moon and produce rocket fuel. The basis of energy on the Moon is solar energy (the moon has the best conditions for the use of solar energy, due to the lack of atmosphere), in the form of solar power plants. Electricity generated on the moon will be transmitted to the earth using laser technology. Moon is gradually being formed. The most interesting are: iridium, osmium, palladium, platinum, etc. Helium-3, which scattered across the Moon, is suitable for thermonuclear reactors on Earth, but such a reactor has not yet been developed.
Mars resources. It is the fourth planet in terms of distance from the sun (after Mercury, Venus and Earth). Its mass is only 10.7% of the Earth's mass. Scientists suggest that Mars once had a dense atmosphere and density. Mars has an atmosphere, but it is incompatible with life. It also has dry land, but resembles an arctic desert on Earth.
The launch of international robotic stations on Mars began in the 1960s. Since then, Mars has been constantly monitored both from the orbit of the satellite and directly from its surface.
Oxygen production on Mars is on the agenda. Its atmosphere contains 95% carbon dioxide (CO_2). Its decomposition produces oxygen (O_2) and carbon monoxide (CO), and from carbon monoxide - oxygen and carbon (C).
Several rovers have been launched on Mars to date. For example, "Curiosity", which landed on the Red Planet in 2012.
To Mars on July 30, 2020, as part of the NASA program, launched - "Mars 2020" and will land on the planet in the crater - "Jezero" on February 18, 2021. Mars 2020 includes a Mars rover – “Perseverance” and a drone – “Ingenuity”. Mission objectives are: to find signs of ancient life; gather important data on the geology and climate of Mars; “Perseverance” is equipped with tools and technology that will pave the way for humans to the Moon and Mars [Mars..., 2017].
NASA is currently working on a project that will allow humans to live and work on Mars. But everything will be tested first on the moon, to avoid dangers. Many technical tasks need to be solved before the colonization of Mars can begin. Jupiter [Mars Exploration, 2019].
Jupiter Resources. After Mars, Jupiter began to be explored using automatic spacecraft.
Jupiter is the fifth planet in terms of distance from the Sun. He is a gas giant, which is separated from Mars by an asteroid belt.
According to the most reliable model, it consists of an atmosphere (with a pressure of 1 atmosphere in the upper layers and 22 atmospheres at a depth), metal hydrogen and a stone core. Its radius is 11 times more the radius of the Earth and its mass - 317 times. The atmosphere is made up of molecular hydrogen and helium.
Launched in 1972 by NASA, the “Pioneer 10”, spacecraft passed close to Jupiter in 1973, took a picture of it, first crossed the asteroid belt and discovered a dust belt near Jupiter. As a result, data on the composition of the atmosphere were obtained, the mass of the planet was determined, the magnetic field was determined and the density of 4 large satellites of Jupiter was determined.
The probe is still on its way, crossing the solar system and heading in the direction of the star Aldearan. According to 2018 data, 6 more missions have been launched to study Jupiter. According to their information, water ice (on Jupiter's satellite "Europe") was discovered.
It is impossible for a spacecraft (especially a manned one) to land on the surface of Jupiter, but it is possible to land on its companion, „Callisto“. Therefore, the issue of building a base on it is considered. In 1997, a plan was developed k – "Artemis", according to which a colony should be set up on this satellite, etc.

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To achieve all of the above objectives, it is necessary, first of all, to create the appropriate infrastructure on the moon, including for research work. For this purpose, a lot of scientific, inventive, technological, technical and economic works are to be carried out.
The engineering side of creating colonies on celestial bodies can be solved, there are many achievements and innovations for this. More difficult is the biological side of the problem of how to avoid radiation that is much higher on these celestial bodies (e.g. Mars) than on Earth. Future advances will allow us to overcome these and other problems on the way to space exploration. To obtain relatively light and strong materials from which objects are made to fly longer at a lower cost. They will also improve their remote control system, transmitting data from space objects to Earth. It can be said that in the not too distant past humanity will create a space economy that will make a great contribution to the development of civilization.

Space Law

At the modern stage, with the development of space technologies (plans to establish colonies on Mars, the development of space tourism, the extraction of minerals), it becomes necessary to legally regulate the basic aspects of human activity in space. The agreement between the countries does not even legally determine where the cosmos begins and what the status of astronauts is, although according to the oral agreement the cosmos begins outside the Earth's atmosphere. It is believed that the formation of international space law began in 1957, when the first artificial satellite of Earth was launched in the Soviet Union.
There are several international treaties on space: the Treaty on the Study and Use of Space by States, including the Moon and Other Celestial Bodies (1967), hereinafter referred to as the "Treaty on Space". Under this agreement, space is open to all countries for peaceful research and use, as well as for scientific research. Space can not be used for any military action. Military personnel may be used for peaceful purposes only. "Treaty on Rescue and Return of Astronauts and Space Objects"(1968), which sets out the actions to be taken by countries in the event of a crew crash, distress or forced landing; The Convention "International Liability for Damage Caused by Space Objects" (1971), obliges the state that launches an object into space to compensate any damage caused by this object to any state Convention “On Registration of Objects Launched into Outer Space” (1974), which lays down the rules for the registration of spacecraft; Treaty “On the Activities of States on the Moon and Other Celestial Bodies”; The Convention “On the Prohibition of the Test of Nuclear Weapons in the Atmosphere, Underwater and Space”. Treaty on the Moon (Australia, Austria, Belgium, Guatemala, Turkey, India, Kuwait, Lebanon, Morocco, Mexico, Netherlands, Pakistan, Peru, Romania, Saudi Arabia, France, Uruguay, Philippines, Chile) . States have the right to collect and bring to Earth samples obtained from research on the moon and to keep them for themselves, however, at the request of other states, they must provide these samples for scientific research. States have the right to use the natural resources extracted on the moon to ensure the operation of their installations. The lunar surface, entrails, areas, and natural resources may not be the property of any state, international organization, or other entity [Agreement…, 1979; United Nations…, 2008].

Space is a common property, and any state can explore and use it, including for scientific research. Only objects launched into space and their parts belong to a separate state. There are some legal acts concerning space, at the national level. For example, the Law of the Russian Federation "On Space Activities" (1993); The United States of America „Space Competitiveness Act (2015), which allows private companies to extract and process minerals for commercial purposes; Luxembourg Law on the“, Exploration and Use of Space Resources (2017).

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Regarding the exploitation of space, the issues of legal regulation of commercial activities in this process are interesting. In the future, the financial responsibility of companies for the extraction of minerals in space should be determined.
According to experts, the need for legal regulation of space tourism will be on the agenda. Space tourists will be subject to certain requirements and will need to be physically and theoretically trained as astronauts.
Business is already interested in space exploration, and companies are implementing such space projects that only states could develop.

Conclusions

1. The focus of the world today is on caring for the natural resources of the future in order to avoid the great danger associated with the depletion of non-renewable resources on Earth.
   The natural resources of the future can be viewed as renewable resources of the Earth, and resources that are still not exploited or are practically inexhaustible. Therefore, the resources of the future, in addition to renewable resources, include the resources of the oceans and seas, as they are still untapped and practically inexhaustible. The resources of the future also include space resources that are not renewable, but not exploited and inexhaustible. Resources of the future are also resources related to renewable resources: building materials, salt, drinking water, forest, air, agricultural resources and products (land, plants, pets and poultry, fruits, garden vegetables, etc.)
2. The Earth's renewable natural resources are: solar radiation; Water and wind energy; Air and water space; Climatic; Geothermal; Biological (animal, plant and household origin); The difference in temperature between the atmosphere and the oceans; The energy of the waves, currents, tides, and tides of the oceans and seas; Sea water temperature gradient energy.
3. The use of renewable resources in the world is growing more and more, but their amount is great still, especially ebb and flow, currents and waves energy of seas and oceans. The sea water energy gradient is the most efficient cold heat source.
4. From the cosmic resources, the resources on celestial bodies (Moon, Mars, asteroids, meteors, etc.) are noteworthy.
5. In space it is possible to get metals, gas and water. The use of water is assumed when working on orbital stations, as well as for its separation into hydrogen and oxygen (fuel for reactors). And gases it is advisable to use on Earth. From metals in space can be found: titanium, nickel, iron, platinum, cobalt and others. Working in space due to low gravity is difficult and dangerous, however, the modern level of development of science and technology gives hope that in the not too distant future, this task will be successfully solved. Probably, robots will do the work in space, and unmanned vehicles will bring resources to Earth. Because of the distance, the newest celestial bodies will be assimilated first.
6. Asteroids possess a colossal amount of resources. A chondritic asteroid with a diameter of 7 meters contains 100 tons of water. A metal asteroid with a diameter of 24 meters contains 33,000 tons of metal. A single platinum-rich asteroid 500 meters wide contains 174 times more of this metal than is mined on Earth in one year.
7. The first asteroid that a NASA spacecraft landed on was „433 eros“. In 2000, the spacecraft left the asteroid and returned to Earth in 2001. NASA mission „OSIRIS-Rex“ traveled to near-Earth asteroid „Bennu“ in 2016 and will return a small sample to Earth in 2023.
8. The moon can be used to: explore Earth and near space; To observe the dynamics of climate on Earth; To explore natural resources; To observe planets close to Earth; To facilitate spacecraft navigation; To assimilate the raw materials and energy resources available on it. The moon can become the primary source of space resources. On the moon are found: oxygen, silicon, iron, titanium, aluminum, manganese, calcium, chromium, silver, mercury, virtually all elements of

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Mendeleev's table.

9. One of the most important resource of the moon is water ice, which will help to settle on the moon and produce rocket fuel.The basis of energy on the Moon is solar energy (the moon has the best conditions for the use of solar energy, due to the lack of atmosphere), in the form of solar power plants. Electricity generated on the moon will be transmitted to the earth using laser technology. Moon is gradually being formed. The most interesting are: iridium, osmium, palladium, platinum, etc. Helium-3, which scattered across the Moon, is suitable for thermonuclear reactors on Earth, but such a reactor has not yet been developed.
10. NASA is currently working on a project that will allow humans to live and work on Mars. But everything will be tested first on the moon, to avoid dangers. Many technical tasks need to be solved before the colonization of Mars can begin. Jupiter [Mars Exploration, 2019].
11. It is impossible for a spacecraft (especially a manned one) to land on the surface of Jupiter, but it is possible to land on its companion, „Callisto". Therefore, the issue of building a base on it is considered. In 1997, a plan was developed – "Artemis", according to which a colony should be set up on this satellite, etc.
12. The engineering side of creating colonies on celestial bodies can be solved, there are many achievements and innovations for this. More difficult is the biological side of the problem of how to avoid radiation that is much higher on these celestial bodies (e.g. Mars) than on Earth. Future advances will allow us to overcome these and other problems on the way to space exploration.
13. At the modern stage, with the development of space technologies (plans to establish colonies on Mars, the development of space tourism, the extraction of minerals), it becomes necessary to legally regulate the basic aspects of human activity in space.
14. Regarding the exploitation of space, the issues of legal regulation of commercial activities in this process are interesting. In the future, the financial responsibility of companies for the extraction of minerals in space should be determined. According to experts, the need for legal regulation of space tourism will be on the agenda. Space tourists will be subject to certain requirements and will need to be physically and theoretically trained as astronauts. Business is already interested in space exploration, and companies are implementing such space projects that only states could develop
15. If earlier the launch of objects into space was associated with multibillion-dollar costs, today they are displayed only in millions and will be further reduced in the future.

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