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ФАКУЛЬТЕТ ЛІНГВІСТИКИ

‘SIGNIFICANT ACHIEVEMENTS IN SCIENCE AND TECHNOLOGY’

“ВИЗНАЧНІ ДОСЯГНЕННЯ В НАУЦІ І ТЕХНІЦІ”

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5G NETWORK GENERATION

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5G (the 5th generation of network) is the name used in some scientific papers and projects to refer to the next 4G mobile telecommunication standards. As of the beginning of 2017, the official 5G standard was not adopted, and the work on its development continued in international organizations. It is assumed that 5G will provide faster data transfer than 4G, as well as allow closer placement of devices and direct interaction between different appliances. Researchers are also searching for ways to reduce delays and reduce power consumption compared to 4G.

The fifth generation of mobile networks 5G promises to be especially breakthrough one. Due to it, unmanned cars, virtual reality and the Internet of Things will actively enter our daily lives. At the moment, fifth-generation communication technology is being actively tested around the world. Mass launch is expected in 2020. One of the coolest programs that were tested during the Winter Olympics was the Interactive Time Slice video demonstration, which used 100 cameras simultaneously located around the Pyongyang ice arena. The video could be "rotated" all 360 degrees and instantly zoom in.

The developers used the concept of replays from video games and turned it into reality: for example, looking at the skater's jump, you could click on the pause and view the jump from a hundred different angles.

Among other things, the 5G standard should provide the following characteristics:

• peak data download speed per base station up to 20 GB/s;

• data download speed up to 100 MB/s and upload up to 50 MB/s for one subscriber;

• the ability of the subscriber unit to travel at speed of up to 500 km/h between base stations (in a high-speed train);

• the ability of devices to switch between power-saving mode and fully-operational in 10ms;

• improved radio frequency spectrum efficiency;

• 1 GB/s data transfer for many users on the same floor at the same time.

Low latency and high 5G data transfer rates can benefit not only the Internet of Things but also drones. It is expected that the next-generation wireless internet technology will provide not only power to self-driving cars, but also to virtual reality, smart city and network robots.

The US mobile carrier officially announced that it would launch its own 5G network in the US by the end of 2018. Residents of 12 cities (including Dallas, Texas; Atlanta, Georgia; Waco, Texas) were able to take advantage of the new technology. The operator emphasized that this is the latest Non-Standalone 5G NR specification, not a "pseudo-5G" (improved 4G/LTE). A similar technology called 5G Evolution already works in networks in 23 US cities.

In 2019, 5G was used for the first time in China. The head doctor performed two remote operations, respectively, at a distance of 710 and 1100 km from the patient. During the operation, 12 screws were implanted in the spine of the patient. On July 19, Vladimir Zelensky met with Mexican investor Peter Foyo, whose specialty is telephony and telecommunications, which is relevant in the context of the development of 5G mobile communications in Ukraine.

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GENERATIVE ADVERSARIAL NETWORKS

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What is GAN?

So called "GANs", or Generative Adversarial Networks, is very perspective technology. Having a possibility of learning more and more with less human intervention, makes GANs the hottest AI topic since 2014 when they were invented and posted by Ian Goodfellow and his colleagues.

How does it work?

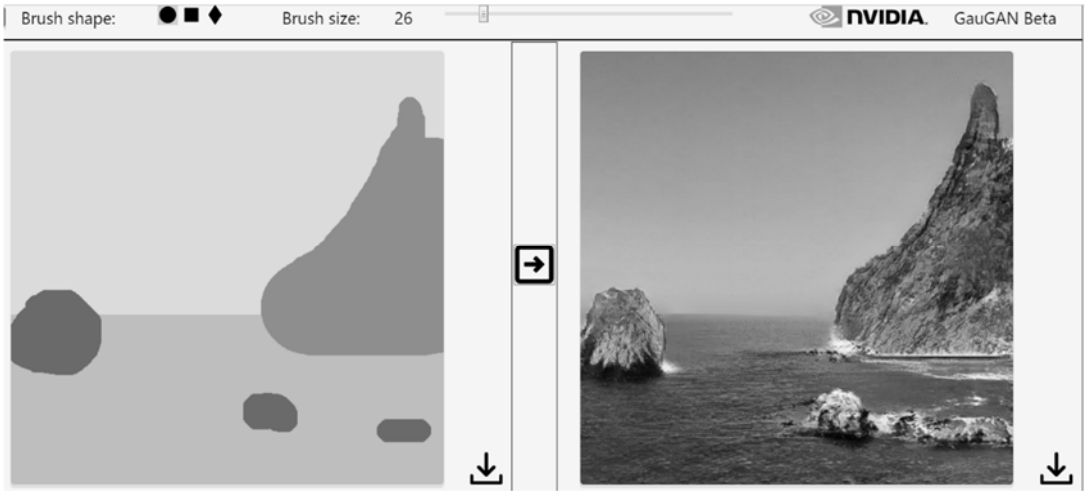
Principe GANs work on is based on zero-sum games, mathematical model that have two players with exact opposite interests. There are two special networks: one generates answers or candidates and called generative network, the other one called discriminative finds and rejects wrong answers. This system is made in such way that both discriminant and generator are taught by each other. Goodfellow said "This is like a competition between counterfeiters and police. Counterfeiters want to make fake money and have it look real, and police want to look at any particular bill and determine if it is fake" (Beckett, J. 2017).

What is the difference between GAN and ANN?

Qualitative differences between GANs and other neural networks is their ability to create new data using only previous results. That's means that they can be used in not just operating with available material but creating completely new one. A great example of this is dozens of sites using GANs for creating nonexistent faces (thispersondoesnotexist.com), any object using only user-drawn sketch (Image-to-Image). But the most advanced project based on GANs is Nvidia GauGAN.

More about Nvidia researches.

GauGAN offers a powerful tool for creating beautiful landscapes from simple scratches to everyone. It allows user to manipulate with scene in any way, set light, materials, buildings by a few clicks. That can lead to an appearance of surrealistic outlooks, images impossible in real life but looking so convincingly. To achieve such results Nvidia team implemented spatially-adaptive normalization in their styled GAN. It is a simple but quite effective method of generating photorealistic pictures.



What's next?

"GANs is the coolest idea in machine learning in the last twenty years…" (Yann, 2016) Despite the fact that GANs are pretty impressive even now, there is a lot to do to make it perfect. Generative Adversarial Networks are good at creating something specific, but the goal is to generate everything you can imagine from animals to black holes simulating in one piece on one sheet.

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THE FUTURE OF UKRAINE'S GREEN ENERGY

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All energy sources can be divided into renewable and non-renewable. Renewable energy sources are characterized by natural replenishment in short periods of time (Babiev, 1998). Because of this, they have constant power. Improving the energy efficiency of the national economy of Ukraine is one of the main ways of ensuring national security, filling the budget, increasing the competitiveness of products in both domestic and foreign markets, as well as solving social issues.

At the current rate of use of oil and gas, these resources will suffice for humanity for 50 years. In this regard, Europeans are actively promoting the introduction of alternative energy sources. Ukraine's plans are more modest: according to the Energy Strategy for the period until 2035, the share of renewable sources in electricity generation will be over 13% in 2025.

At the moment, the fastest growth rate in the world for 2017 is shown by solar power, although its efficiency is up to 30%, hydroelectric power plants at the same time with efficiency up to 70% have a slower growth rate. Such dynamics are explained by much larger budgets for the launch of hydroelectric power projects and the complexity of the HPP implementation.

However, wind power is growing at a much slower pace - in the year, the capacity of wind power plants in Ukraine has increased by 27 MW, totaling 465 MW. This situation is due to the fact that the hydroelectric power plant is several times more expensive than the hydroelectric power plant, much more difficult to install and requires special maintenance. That is why large investors, not small companies, play in this market.

In Ukraine, a system of financial privileges was created to stimulate energy conservation and use of alternative energy sources and is enshrined in the Tax and Customs Codes and the Law of Ukraine "Proelectroenergetics". The energy independence that our country strives for lies not only in the rational use of energy, but

also in the development of energy as a whole. Today, this development is about investing in renewable energy. It is much cheaper to build SES than coal or thermal power plants. That is why increasing the share of energy from renewable sources is today a top priority for energy development. Facilitating the entry of alternative businesses in Ukraine to new businesses can give a powerful blow to green energy development and support energy efficiency and energy conservation policies.

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DEVELOPMENT OF ANTI-CORROSION ENVIRONMENTALLY SAFE TECHNICAL DETERGENTS

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To solve the problem of the rational use of fuel, energy and environmental resources it is necessary to increase the productivity of technology and to attract non-waste or low-waste technologies.

During exploitation of the compressor equipment, the internal elements of the gas pipeline tracts are contaminated with aerosol deposits. This results in a significant loss of power and increases energy consumption. Activation of corrosion and erosion processes destroys the blades of compressors and turbines. An effective way to prevent the destruction of industrial equipment is to use closed flushing systems (Korhonen & Wihersaari, 1999). Therefore, it is urgent to develop effective technical detergents (TD) for cleaning the elements of the compressor equipment.

The main requirements for TD are high cleaning ability, low salt content, low corrosion activity, environmental safety, no fire hazardous solvents, low temperature performance (Abramzon, 1993).

An important characteristic of TD is its corrosion properties. The choice of

anti-corrosion ingredients for TD implies a positive or neutral effect on the effectiveness of the detergent composition. Innovative in the choice of anti-corrosion modifying TD ingredients is the use of high molecular weight polymeric materials that in turbidity delay the development of turbulence and at high flow rates reduce the resistance of the solution compared to pure water. The presence of polymeric ingredients prevents the phenomenon of cavitation, and therefore prevents the destruction of pipelines, washing machine elements. CELLOSIZE esters with different molar masses (C-1 - C-10) and the methyl-pyrrolidone (N-MP) nitrogen-containing compound were considered as modifiers.

The corrosion rate (I_c) of steel specimens at its contact with the wash solution was determined by the magnitude of the polarization resistance, by the formula:

$$I_c = \frac{k}{R_p}$$

where I_c is the corrosion rate, mm/year; R_p – polarization resistance, Ohm; k is a constant that takes into account the electrical parameters of the corrosion process, the physicochemical parameters of the electrode (atomic mass, time of flushing per year, density and area of the electrodes)

In the experimental determination of polarization resistance, results were obtained, indicating the rational nature of its dependence on time. The highest value of polarization resistance was reached after 40 min. The results of the study are presented in graphs (Fig 1,2).

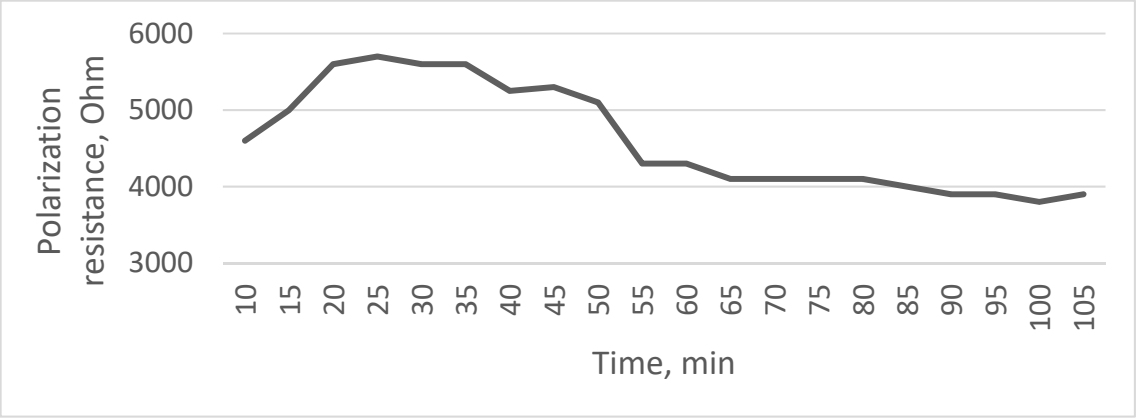

Fig. 1 Dependence of polarization resistance on time in aqueous hydroxyethyl cellulose (C-4).

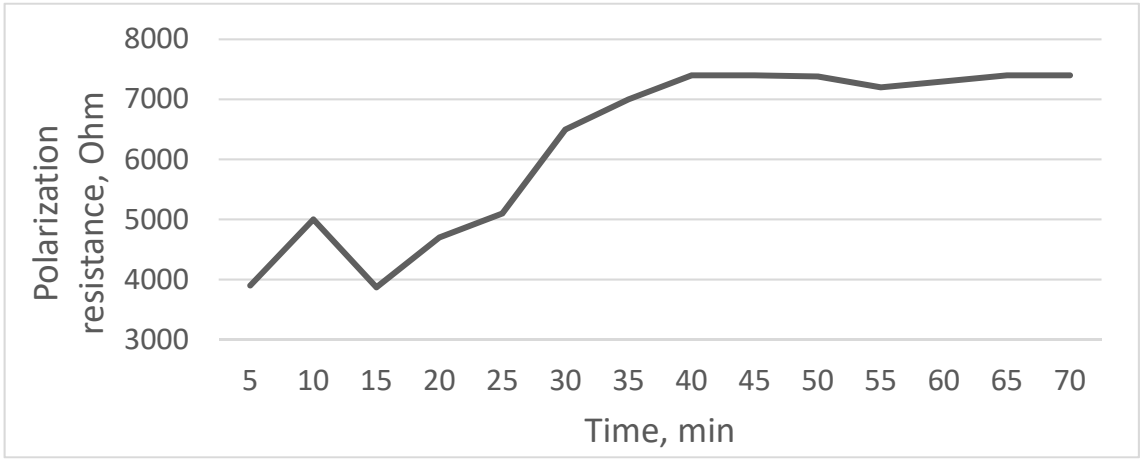

Fig. 2 Dependence of polarization resistance on time in aqueous N-methylpyrrolidone

Corrosion rates were calculated in pure C-1 solution and in C-1 + N-MP system at their content, %: [C-1] = 10^{-3}, [N-MP] = 10^{-3}. According to the results obtained, it can be argued that the introduction of N-methylpyrrolidone into solution C-1 has a significant effect on the corrosion rate.

Similar studies have been performed on systems with longer hydrocarbon skeletal carbohydrate skeletons.

It was found that the introduction of N-methylpyrrolidone into the system with C-3 almost did not affect the value of polarization resistance, and for aqueous solution C-4 introduction into the system of N-methylpyrrolidone did not change the quality of the inhibitory action of the solution. For an aqueous solution of C-5, the introduction of N-methylpyrrolidone slowed the corrosion rate by more than 2-fold, and for an aqueous solution of C-10 the introduction of the modifier increased the resistance by almost 3-fold.

Comparison of the corrosion rate calculations in pure hydroxoethylcellulose solutions with velocities in the presence of N-methylpyrrolidone showed that the result was significantly influenced by N-MP, and in systems with C-3 and C- 4 he did not play a role. Therefore, it may be possible to exclude N-methylpyrrolidone as a component in systems C-3 and C-4.

This capability will help reduce the total salt content of TD, which will reduce energy and clean water consumption for flushing.

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HEAT PUMPS

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The use of heat pumps in the hot water supply systems of buildings presents a great prospect. It is known that heating buildings requires the same amount of heat. In the building, as a heat source with a low energy potential the heat of the earth is used, as well as the heat of the removable ventilating air.

The source of heat with a low energy potential can be heat of both natural and artificial origin. As energy sources can be used:

• soil heat;

• groundwater;

• outside air.

As the artificial sources of heat may be used:

• removable ventilation air;

• wastewater;

• industrial waste;

• household heat dissipation.

Thus, heat pumps are the most successful.

Previously, a heat pump was used primarily for cooling the air. The system was

also able to provide a certain heat output, more or less satisfying the heat demand in winter. Currently, in many countries of Europe, heat pumps are used in heating and domestic water heating. Now, the use of alternative energy sources, for example, solar is popular. For mass consumption, one of the most preferred options for the use of alternative energy sources is the use of low-grade heat through heat pumps.

There are different classification options for heat pumps. Limiting the division of systems into their main functions:

• heat pumps for heating and/or hot water supply only used to ensure a comfortable temperature in the room and/or to prepare hot sanitary water;

• integrated systems based on heat pumps that provide space heating, cooling, domestic water heating, and sometimes the use of exhaust air. Water heating can occur either from the evaporation of heat, or from the emission of heat from a condenser.

Heat pumps for the preparation of domestic hot water are often used for exhaust air.

It should be noted that the offer of reversible "air-water" class heat pumps is gradually expanding, which are increasingly being supplied complete with an expansion tank and pump unit. A storage tank is available on request. Such pumps can be embedded in open water systems.

In Germany and other countries of Northern Europe, heat pumps that are used in the ground are common. The range of thermal power is from 5 to 70 kW.

Heat pumps are in demand primarily in cases where other ways of organizing a heating system are much more expensive. The increasing prevalence of heat pumps in production and in connection with these advantages: profitability. For transmission to the heating system, 1 kWh of thermal energy is required; for installation, on average, only 0.2–0.35 kWh of electricity is required.

Simplicity of operation. Simplification of requirements for ventilation systems of premises increases the level of fire safety.

Ability to switch from winter heating to summer air conditioning. Compactness and noiselessness make the heat pump attractive for heating a private house.

According to the European Heat Pump Association, until recently, the European market for this equipment was mainly concentrated in France. Over the past few years, markets have expanded in Germany, the UK and Eastern Europe. According to the World Energy Committee, the share of the population in heat transfer is at least 75%. A common drawback of heat pumps is not very high temperature. As a rule, it is 50-60 ° C.

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ENERGY OF SEA WAVES

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For sure, everyone has repeatedly felt the power of the waves on themselves and saw how the waves destroy buildings and moorings. It would be quite reasonable, along with devices that convert the energy of the sun and wind into electricity, to use the energy of sea waves for these purposes. Moreover, Ukraine has a coastal zone of the Azov and Black Sea.

The strength of the waves on the surface of the seas and oceans, like any other energy, can be used for useful work, including for ensuring the operation of power plants. According to experts, the waves of the oceans can satisfy from 20% of the energy needs of the mankind.

Wave energy seems to researchers a no less serious direction of alternative energy. According to the most daring estimates, the waves generate about 2 TW of energy, which is twice the total volume of energy production in the world today. The attractiveness of using waves lies primarily in their high specific power, which in its

level exceeds the performance of solar and wind energy. Under conditions of a ten-meter wave height, the specific power reaches 2 MW per linear meter. Technically, the use of wave energy is possible only in coastal zones, where the power is a maximum of 75–80 kW per, and the average wave height is up to two meters.

Principles of work of wave stations

Energy is generated from the waves of the seas and oceans by special wave power plants located in water areas. In addition to generating electricity, using additional equipment, wave stations can perform other useful work, including generating heat, fresh water, oxygen, hydrogen and other chemicals from seawater using electrolysis processes, as well as producing compressed air.

The work of the stations is carried out due to the effect of waves on their working bodies, which may be, depending on a specific project, floats, turbine blades, pendulums, pipes, wave receivers or wave pickups. The movement of the waves is ultimately transformed into the rotation of the generators with the help of power converters – air and hydraulic turbines, chain and gear transmissions, or water wheels. The mechanical energy obtained as a result of the action of the waves is converted into electrical energy, after which it is transported to consumers through a marine cable on the coast.

Waves can be used to generate energy at stations operating on the principle of an "oscillating body." The working bodies of the stations are buoys, sections of which are combined into one converter. Hydraulic pistons are installed between the sections, which, under the influence of vertical waves, rotate the generator through special engines. The transformation is applied not only to the energy of wave oscillations, but also changes in their profile when using the principle of "surface rolling". As working bodies, floats are installed. In the designs of Soller's Duck stations, several dozens of floats are mounted on a common shaft.

Existing and future projects

To date, the share of use of stations operating on waves is very small. For the most part, the implementation of such projects is experimental. Nevertheless, wave energy has found its application in the energy supply segment of individual

autonomous objects, such as lighthouses, buoys, offshore research equipment, and drilling platforms. For example, about four hundred lighthouses and buoys are now working on wave generators around the world. Large power plants can be counted on the fingers, and some of them are still under construction. Let's get acquainted with some projects.

The Australian company Oceanlinx, commissioned by the energy operator Diamond Energy and with the assistance of the Australian Renewable Energy Agency, built for $ 8 million a wave power station in the Port Kembla area (a suburb of Wollongong). The station was launched in 2005. During operation, it was decided to modernize the capacities, and after a break, the wave generators started working again in 2009. The facility's capacity is 1 MW, while consumers receive about 450 kW of energy.

In 2009, the construction of the largest wave station in the world as a part of the Wave Hub project began on the coast of the British county of Cornwall (washed by the English Channel and the Celtic Sea). The project operator was Carnegie Wave Energy (Australia), which received a EUR 9.6 million grant for the construction of the first megawatt generator for the construction of a European Regional Development Fund. The design of the generator provides for the installation of PowerBuoy turbines manufactured by the American company Ocean Power Technologies. The station is being built according to the technology of float working bodies. The design capacity of the facility will be 50 MW. It is assumed that the launch of the station will take place in 2018. The second phase of the project, which provides for the increase in production capacity, is designed for 2020–2021. According to unofficial data, the operator has already managed to achieve a station capacity of 20 MW.

In Ukraine, NPK KROK-1 has developed a standard design for a wave station with a capacity of 2000 kW for the Black Sea, consisting of four 500 kW modules. There is no practical implementation yet, although a prototype of such equipment for the use of sea wave energy VES-10 (10 kW) was tested in the spring of 2007 in the Black Sea and showed satisfactory results.

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POSITIONING OF MODERN ROBOTS

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Today it is difficult to imagine digital technologies without robots and robotic machines. People use robots in various fields: in the military and industrial, in medicine and in everyday life. Nowadays, they are becoming more and more sophisticated and advanced.

One of the main requirements for ensuring the autonomy of robots is spatial orientation and the ability to know their own position. There are many ways to solve this problem, but I want to tell about inertial navigation system, which is one of the most perfect and ingenious in its simplicity. Also there is very cheap and autonomous, weather conditions do not affect its operation, it is not susceptible to electronic suppression and provides stealth (it does not generate electromagnetic radiation that emits the presence of a carrier object).In that system, to solve navigation problems, a certain number of inertial sensitive elements is used - gyroscopes and accelerometers that provide information about the parameters of the

object’s movement.

Let's look at the work principle of the inertial navigation method. To obtain information about all six degrees of freedom of a mobile robot, six sensors are used - three gyroscopes (Gx, Gy, Gz) and three accelerometers (Ax, Ay, Az), which provide comprehensive information about its angular and linear movements. The on-board computer collects and filters data from these sensors, and on their basis calculates the navigation parameters of the robot: yaw, pitch, roll, distance traveled, speed and acceleration. The received information can be displayed in various forms, such as a graph or numerical values, or stored in a log file. This data can be also used for PID regulators.

Besides I should mention the main drawbacks of this navigation method. The first drawback is the need for initial settings for speed and spatial position. The second minus is that with time accumulates an error in determining the navigation parameters of the object. The last drawback is easily corrected by Kalman filtration, which is reduce error to the minimum.

To sum up, due to the increasing requirements for autonomy of robots year by year, there is a need to use simple navigation methods to expand their functional capabilities for orientation on the terrain, mapping, passage along safe routes, etc. This text describes a system of local inertial navigation, one of the main components of robots` navigation complex.

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DRIVERLESS CARS

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The modern world is changing very quickly. Although only 50 years ago the Internet was invented, but now people have reached a lot in the development of artificial intelligence. One of the technologies associated with artificial intelligence is driverless car.

What is a driverless car? This is a car equipped with an automatic control system, able to move from one point to another without human intervention.

To arrive at the destination, the driverless car must know the route, understand the environment, comply with traffic rules and correctly interact with pedestrians and other road users. To meet these requirements, the drone uses the following technologies: cameras, radar, lidar and AI.

An organization called SAE International has standardized 5 levels of autonomy that are obeyed to in the automotive market: **Level 0** (No automation), **Level 1** (Driver Assistance), **Level 2** (Partial Automation), **Level 3** (Conditional Automation), **Level 4** (High Automation), **Level 5** (Full Automation)**.**

Most automakers realized that they needed to develop autopilot and started opening new departments and buying startups. Many IT companies, such as Google or Facebook, are also involved in this development. The most progressive companies in this field: General Motors, Waymo, Uber, Lyft, Tesla, and Baidu.

I would like to talk about the most advanced company Waymo. The oldest startup was founded in 2009. Now it is considered the most advanced unmanned vehicle. Valued at $175 billion, Waymo has already driven a combined 10 million miles with Chrysler, Honda and Jaguar cars. In 2018, Waymo announced its plans to buy another 62,000 Fiat Chrysler for a future paid driverless taxi.

Now "Waymo One" service on cars, which are designed for driverless driving, like Chrysler Pacifica, works in the Phoenix suburbs, including Chandler and Tempe.

Despite the declared "Autonomous status" of the vehicle, the driver still sits behind the steering wheel, performing the function of the operator of unmanned maneuvering.

The new Waymo project will be truly unmanned-there is no operator in the cars. This technology was first used in the United States in 2009 at trials in Mountain View, California, and was conducted as part of the Google Self-Driving Car Project. In the following years, the company increased its travel experience and even launched tests in other cities, as well as honed the unmanned functionality of the machines.

In 2016, the project stood out as an independent company, which opened a test center in Chandler, it accustomed to trips around the suburbs of Phoenix and prepared for a commercial launch. The pilot loyalty program Early Rider with the order of unmanned taxis was implemented in April 2017.

Waymo One is a commercial service for the use of driverless cars through a mobile application that has adopted the established customer base. Although the Waymo cars could occasionally be seen at work, they had not been used for mass transportation before, so the current solution is key for the carrier.

Nevertheless, a number of questions remain. It is not yet clear which part of the Waymo cars will be fully autonomous and what restrictions will be imposed on such transportation. It is likely that they will operate in simpler, controlled environments for a few months and then be extended to situations that are more complex.

Waymo actively engages a number of well-known automakers in order to accelerate the introduction of driverless cars into everyday urban life. The ambitions of the company, part of the Alphabet holding, in the fastest possible spread of autonomous transport technology, which can be traced through partnership agreements. Following the agreement signed in the summer with the Renault-Nissan-Mitsubishi Alliance, the company began to prepare for the launch of robotaxy in Paris. This project is implemented together with Renault. In Paris, the unmanned taxi service will not operate throughout the city, but only on the 34 km long section between the airport “Charles de Gaulle” and the business district of La defense,

located in the North-West of the capital. The use of specified routes or transport corridors is a normal practice for test projects in the field of autonomous traffic. This is the first step towards regulatory authorities giving permission to launch a full-fledged unmanned vehicle. The launch of the robotic taxi in the French capital will be the company's first major project outside the US, where Waymo is already conducting large-scale tests on public roads.

To sum up, I think that soon there will be driverless cars that will make our lives more comfortable, but we must not forget about safety on the road, even with autopilot.

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ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Now in our country and in other countries of the world there are considerable difficulties with providing population with pure drinking-water because of its pollution.

Cleansers, including detergents that contain phosphates, getting into reservoirs can cause an euthrophication. It is observed in the rivers of the town Pervomaisk in

Mykolaiv region. Compounds of phosphorus accelerate reproduction of water-plants, especially blue-green ones that in the process of the biological development diminish the content of oxygen in water and form toxic substances. Fresh water becomes dangerous for life (Jacyk, 2012, p. 216).

This paper considers the development of scientific and technical progress in chemical industry. There is increased concentration of contaminants of environment by phosphates as the effluent washing off of mineral fertilizers from agricultural lands contaminate the sewer and superficial water. In addition, there is a stormy "water-bloom" in rivers and the negative effect of phosphates on the human body.

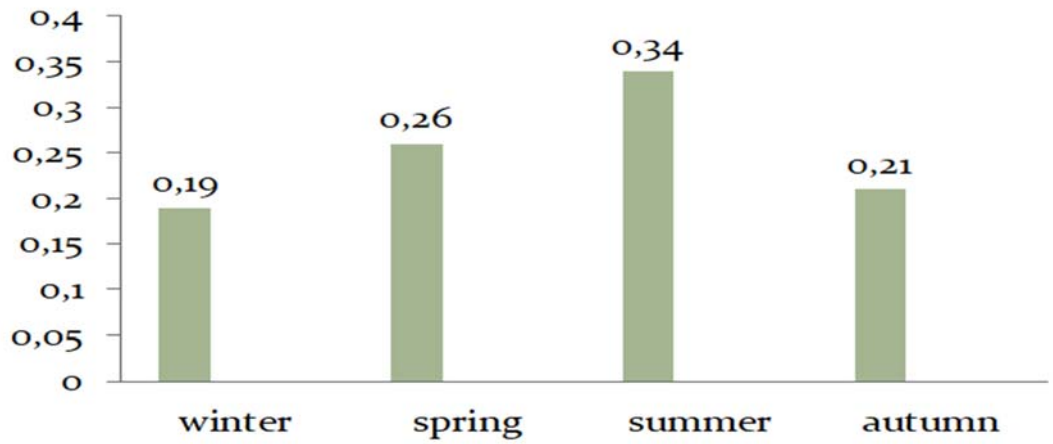
The research described in this paper is based on the case of identification of content of phosphates in the rivers of the town Pervomaisk and exposure of phosphates in detergents.

It was necessary to conduct the analysis of water with the help of photometric method, analysis on the presence of anionic phosphates every season, to investigate content of phosphates in detergents, to set forth recommendations as to the use of phosphoric cleansers.

The tests of water were taken from 4 places: place 1 is South Bug, higher city, place 2 is Sinuha, higher city, place 3 is a place of confluence of the rivers South Bug and Sinuha, within the borders of the city and place 4 is South Bug, below the city.

A qualitative reaction to orthophosphoric acid salt was used for these purposes and cation of silver with a phosphatic anion formed yellow sediment of phosphate of silver.

Determination of content of phosphates was carried out according to methodology based on co-operating of phosphate with a molybdate to the ammonium in a sour environment (Romanenko, 2013, p. 28).



On the drawing 3.1 the dynamics of change of phosphates depending on a season is represented. The highest concentration in the summer is 0.34 mg/dm^3. This happens due to the fact that the products of household chemicals are thrown into the river, cleansers that contain phosphates in particular.

The researching of powders (Rex, Gala, Losk, Tide, Ariel) showed that not all manufactures write about content of phosphates. Qualitative reactions have shown that each powder contains phosphates. This fact was not indicated on the labels of powders "Rex" and "Losk".

Analysis of waters has shown that water purification from compounds of phosphorus at the station of purification of municipal flows was conducted not well enough. It is well-proven that in place 3 (the place of confluence of the rivers South Bug and Sinuha) a maximal concentration of phosphates is 0.23 mg/dm3.
Consequently, it is confirmed that content of phosphates depends on a season, the highest content is in summer (0.34 mg/dm^3). Finally, the content of phosphates is well-proven in powders of "Rex" and "Losk"

To sum up, if we want to change the situation, water purification should be carried out according to new technologies at the station of purification municipal flows. Further, there should be abandonment of phosphor-containing cleansers. It is very important to deal with releasing the used products of domestic chemicals and treating them property.

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WIND ENERGY POTENTIAL DEVELOPMENT: WORLD AND UKRAINE

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Nowadays, mankind is very much concerned with the environmental situation all over the world. People are trying to reduce the negative impact of different industries and apply state-of-the-art technologies to mitigate the consequences of human activities. Wind energy appears to be a good alternative enabling us to reduce the effects of using non-renewable energy resources.

Therefore, the demand for wind energy is increasing. There is a global trend of progressive industries to develop this prospective energy sector. It is clean, cost effective and sustainable. This renewable and sustainable energy allows addressing climate change concerns. That is why the wind power is in demand in the most developed countries, with a growing number of wind turbines already being used to produce energy.

One of the most advanced countries using the wind energy on a large scale is China, covering over a third of the world's wind energy capacity. The USA and the European Union also pay much attention to development of the wind energy sector. Scientists note dramatic improvements in the wind technology that enables forecasting the growing demand for the construction of wind farms and parks, applying the cutting edge science in this industry (Composite solutions for the wind energy industry, 2019).

As for Ukraine, it also has great wind energy potential. There are many projects for the construction of wind farms in different regions that are in the development stage now. The vast areas adjacent to the Black Sea and the Azov Sea have been already used for this purpose.

According to new data released by wind energy trade body WindEurope, Ukraine appeared to be among the five countries in Europe for onshore wind energy installation. It demonstrated impressive results, being ahead of Germany and Italy, with 262 MW of wind energy capacity installed during the first half of the current year.

According to the calculations of the Ukrainian Wind Energy Association (UWEA), the total number of projects currently under construction in Ukraine is 893 MW (Ukraine to double wind power capacities in 2019, 2019).

The growing demand for wind energy capacity in Ukraine is explained by a number of reasons. Firstly, Ukraine makes efforts to diversify its energy sources by increasing the use of renewables. Use of the wind power would boost the country's energy independence. Secondly, such technologies allow using the country's natural advantages and address some ecological problems connected with environmental pollution caused by the use of conventional energy sources.

Traditionally, Ukraine has been dependent on the coal mining industry closely connected with energy production. Today, an increasing number of countries refuse from coal mining industry for its being environmentally harmful and move to the development of renewable sources of energy. Due to the armed conflict in Eastern Ukraine, the country suffers a shortage of coal supplies from the uncontrolled territories. This factor also made the government start seeking for new ways of energy production. Wind energy sector is also very attractive for international investors, and the country needs them to stabilize its economy.

Therefore, both Ukraine and most of the developed world countries are facing similar environmental and economic problems that could be well solved by using the wind energy. According to industry experts, one third of the world's electricity needs will be fulfilled by wind power by 2050 (Europe has the untapped onshore capacity to meet global energy demand, 2019). I believe that the demand for wind power will continue as this energy sector is very promising and shows great potential all over the world.

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CINEMA PRESENCE EFFECT: USING IMAX AND CINETECH+ TECHNOLOGIES

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Nowadays people are so used to a variety of technical innovations that it is becoming more and more difficult to be surprised. Everyone has been accustomed to 2D and 3D and huge screens in cinemas. But the new impulse to cinemas was given by the development of South Korean company regarding the process of showing films (Adamenko, 2016).

The motto of the new technologies was: "See everything and even more". Indeed, the effect of full presence was achieved by using the IMAX and CINETECH+ technologies. These two designs have many common characteristics and excellent features.

In this paper we consider the IMAX technology. Firstly, the IMAX optimized size of

screen like a five-story house. Secondly, the angle of curvature of the screen is determined according to the individual criteria of a hall. Unlike ordinary cinema halls, the IMAX system uses two powerful projectors. It provides an excellent balance of colours and a clear picture that is hard to distinguish from reality. Also, projectors do not work stationary but adapt to each film.

According to the audience at IMAX cinemas, you can see a lot more images. The fact is that the super reality effect is achieved through the using of two video rows simultaneously (Nedobiy, 2017).

Like the IMAX system CINETECH+ uses a special cinema hall geometry that resembles the semicircular shape of the ancient Greek theater (Nedobiy, 2017). This property guarantees comfort during viewing regardless of the seat position.

The CINETECH+ feature is projectors Darco and Christic that create natural colours and rich black (Avramenko, 2016).

The last trend in the 3D world is circular polarization. This technique is taken as an example of the best world's analogues and based on the Leonix system. The projector switches 72 frames per second for the right and left eyes. Thanks to this illusion of cosmic depth is achieved. Giant screens are covered with a thin layer of silver. That is why light of xenon lamps is better reflected (Nedobiy, 2017).

Due attention is paid to sound insulation. The developers took care and reduced the level of noise side by 4 times. In addition, the acoustic system is divided into sublevels and distributed in different parts of the cinema hall.

As we can see, the conditions for creating a new generation of 3D films are quite simple. But large sums of money are needed for its implementation. According to the estimates, the construction of IMAX or CINETECH+ cinema will cost as the construction of ten ordinary (Adamenko, 2016).

But in spite of this fact, the residents of Kyiv, Odessa and Lviv have already had the opportunity to enjoy the new super reality. This season such progressive film companies as "KinoPlanet" provide the opportunity to watch the latest works and experience all the pros and cons of the IMAX and CINETECH+ technologies.

With the advent of new technologies, cinema has significantly expanded its

boundaries. The effect of the presence of CINETECH + IMAX continues to improve and use amazing technical inventions. Owing to this we now have the opportunity to enjoy something that previously had been considered impossible.

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LED LIGHTING

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Given the importance of energy conservation on a global scale, virtually all countries are undertaking various activities to reduce energy consumption in both the industrial and social spheres. Many countries around the world have adopted national energy-saving programmes. Such a program has been developed in our country.

Energy-saving technologies are developed and implemented in many areas to save heat and electricity. The most effective are – automation and optimization of combustion modes, the invention of fuel-less systems for production of electricity, improvement of vortex technologies deerelawn, the introduction of new water treatment plants in the heat, replacement of obsolete boilers with new, the technology of oxy fuel combustion in boilers with fluidized bed furnaces, the method of deep heat recovery of flue gases, minimize the magnitude of the blowdown boiler and add-on boilers with turbine units, dispatching of the heat supply systems the use of asbestos cement pipes in heating, accumulation of thermal energy, glazing of loggias and balconies, transition to a two-rate tariff when paying for thermal energy, development of a strategy for the development of generating capacities,

reconstruction of boiler houses of an industrial enterprise in a mini-CHP, design of reactive power compensation for energy-efficient operation of transformers, replacement of incandescent lamps with fluorescent and energy-saving lamps, creation and implementation of infrared motion and presence sensors, use in housing and communal services of frequency-controlled drives and many other areas.

The vector of our present and future development and human life lies through energy-saving technologies.

Energy-saving technologies are at the stage of revolutionary development. Modern science, in particular solid state physics, fundamentally changes approaches to this problem.

A revolutionary breakthrough is the use of led lighting (light-emitting diodes, LEDs). Until recently, they were used as indicators, for example, a red dot on the control panel of the TV or where you do not need more brightness - to illuminate the display of the mobile phone. However, the success of solid state physics and a new branch of technology - optoelectronics, as well as nanotechnology made it possible to use LEDs for lighting.

Lighting consumes about 20% of the electricity produced, which for Ukraine is about 40 billion kWh. Switching to led lighting will reduce this value by at least 10 times. The savings will be approximately 36 milliard kW/h. or 8.8 milliard UAH. at a cost of 24.36 kopecks per 1 kW / hour. This energy savings is equivalent to a reduction in coal consumption of 5.14 million tonnes, which is produced in eight medium-sized mines. To this should be added an additional effect, especially in the commercial sector. Reducing the heat radiation from led lamps will reduce the cost of cooling the premises, which, for example, for a large store, where a lot of lamps and they burn almost around the clock, is very important.

But these are arithmetic indicators. Led lamps are more convenient to operate. They are insensitive to power surges, allow frequent switching, and this does not affect their service life. Already now for the produced led lamps it is 40 thousand hours and is continuously growing. In the next two years, it will increase 2-2.5 times. There are other advantages.

Led lamps do not emit ultraviolet light. Their light is almost identical to the natural light, which improves people's health and, accordingly, saves health care costs. The luminous flux is easily adjustable not only in magnitude but also in direction. But most important: led bulbs are absolutely safe. They do not require special disposal conditions. It makes sense to collect waste lamps for the secondary use of semiconductor elements in the same way as waste paper or glass containers are collected.

The problem of energy saving does not exhaust the whole range of issues related to the efficient use of energy. It is necessary to move to more optimal ways of using it.

In the current conditions, the energy supply system of Ukraine requires radical reconstruction. And it must be done comprehensively. It is not a matter of increasing the capacity to produce energy, although this is indispensable. The basis should be the achievement of maximum energy efficiency, which will be an integral part of the development of revolutionary technologies based on the most advanced achievements of science.

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GRAPHENE AND ITS FUTURE IMPACT ON OUR LIFE

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Graphene is one of the strongest and multi-purpose materials on Earth. First time when we heard about it was in 2004. So, why do we still know nothing about this material? Let's find out.

Graphene is just carbon such as graphite, diamond, fullerene or coal. The main difference is bonds between carbon atoms: they are incredibly strong. That makes graphene a very strong material, but it is also very flexible and it is a highly efficient conductor of electricity. The way this material can be used is inexhaustible.

So, the issue is that it is hard to produce it in large amounts. Graphene was gained for the first time in 2004 by the United Kingdom researchers. They realized that graphene production can be shockingly simple. They just put some standard issue tape down onto the graphite and just lifted it off. So, it is a great option to get some graphene. But it is still hard to produce enough graphene to use it somewhere on a large scale.

Graphene is a very promising material that could be a breakthrough in science. These days, the hype on smartphones is the biggest ever before and it is growing every year. As it was mentioned before, graphene is ultra-strong. It is 200 times stronger than steel. This feature allows the creation of unbreakable smartphones. The technology allows producing clothes that can't be snapped and airplanes which are not afraid of the scariest storm too. Thanks to great electricity conduction using graphene we can make batteries that will charge up our smartphones, electric cars and any another device within a few minutes. Another feature is very big tightness. Only water atoms could pass through the graphene. So, we can purify the water and thus graphene filters can solve the problem with the lack of fresh water.

The bravest statement: graphene can beat the cancer! Research shows that this nanomaterial can neutralize the cancer cells and, what is most important, it is non-

toxic for healthy cells. That means the graphene treatment could have much less side effects than the traditional methods. Thanks to graphene we can remove the metastasis that is the cause of death in 90% of cases.

Graphene is one of the most important inventions of 21st century. All we need is to be patient and hope for near-term breakthrough in researching nature of graphene.

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MALWARE AND HOW TO DEAL WITH IT

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Malware (malicious software) is a group of programs which can make harm to your computer or other device, and can be used to monitor your online activity, to collect your personal data (in other words steal it). It's really dangerous today. With software development, ways and methods to pass its security evolves too. If you've got some of your programs updated, it does not guarantee you're completely protected from malicious software. The foremost purpose of malware is to bring damage to your computer, to its content and directly to you, the user in any way. It includes viruses, adware, rootkit, key loggers, and spyware. All they can get installed on your device without your awareness.(Federal Trade Commission, 2013, p.1)

They also have an opportunity make your gadget vulnerable to viruses and deliver unwanted or inappropriate ads. Computer viruses were one of the first

malicious programs. Nowadays it's a rarity to encounter it, because it was mostly forced out by other types of malware.(Igor, 2015, p.1)

Malware is a quite common type of Cyber threats, so it's not excluded that exactly you will run into this. There are so many websites, where various types of malware could be hidden (mostly because of the free stuff). Somehow you can be subjected to risks to get some absolutely unnecessary files. (Federal Trade Commission, 2013, p.2)

What kind of damage could it bring? There are lots of cases, when unfriendly ware that spoils user's computer system : it spends computer resources, thus reducing its work speed; it collects user's personal data such as bank accounts, passwords, logins; it establishes advertising programs like popup windows and banners. Such malware works even when it has not access to the Internet. However, there's a lot you can do to protect yourself and your data.(Federal Trade Commission, 2014, p.1)

Fortunately many of "good guys" developed antivirus software. Such programs definitely should be set on your device, because it helps the user to find malware and remove it. But it is better for you to keep away from the places where these unwanted stuff are. Here are some tips to reduce the risk of downloading malware:

- One of the most important ways to be secure is to install and update efficient security software from reliable sources and developers.
- **Try not to change your browser's security settings.**
- **Check your browser** to see if it has tools to delete malware or reset the browser to its original settings.
- If your device behavior looks suspicious – stop doing anything that requires your passwords or personal information.
- The significant part of preventing malware is to keep software up to date.
- **Back up your data regularly. (Federal Trade Commission, 2014, p.1)**

As you see, depending on the type of malware not only safety facilities may vary but the methods to deal with them. So keep in mind that you should be careful

about your device security.It is worth saying that your safety level certainly depends on your attitude.

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ARTIFICIAL CULTIVATION AND PRINTING OF HUMAN ORGANS

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Organ cultivation is a promising bioengineering technology that aims to create a variety of viable biological organs for humans. Organ cultivation is the hope of humanity for salvation, because thousands of people have incurable diseases and need an organ transplantation. Therefore, scientists around the world are trying to address the problem of organ transplantation deficiency, as well as reduce the risk of alien tissue rejection.

How this happens?

Stem cells are most commonly used for organ growth, but somatic cell grafting is also popular to restore some tissue areas. However, it is the stem cells that can grow from several cells to healthy organs.

Stem cells are capable of division, however, they use a matrix to provide them with nutrients and comfortable conditions. For example, stem cells are used to grow

heart cells, which are placed inside a structure (matrix) of connective cellular tissue, consisting mainly of collagen protein.

Thus cells multiply and form the whole organ. The collagen matrix can be obtained by purifying cells from donor biological tissue or created it artificially from biologically solid polymers or special ceramics when it comes to bones. Also, nutrients and growth factors are introduced into the matrix, after which the cells form a single organ or some "patch" designed to replace the affected part.

The cultivation of artificial heart, lungs and other vital organs for transplantation to human is only under investigation today. However, easier operations are performed. A known case of transplantation of a patient with a grown trachea performed at the RNC Surgery. B.V. Petrovsky under the direction of the Italian professor P. Macchiarini. In this case, the donor trachea was taken as the basis, which was carefully cleared of cells. Stem cells taken from the bone marrow of the patient were introduced in their place. Growth factors and mucous fragments were also placed there - they were also borrowed from a damaged trachea of a woman who had to be rescued.

Undifferentiated cells under such conditions gave rise to cells of the respiratory epithelium. The grown organ was implanted into the patient, and special measures were taken to germinate the implant with blood vessels and restore circulation.

Scientists have also been able to grow whole organs on the body (xenotransplantation)

Stem cells that are planted in a nutrient medium are also used for this purpose. Cells are encoded and actively propagated. Then, the "rudiments" of organs are planted on the body of man or animal. For example, in 2008, scientists from China have grown the ear on the back of a laboratory mouse.

Now the progress is developing and scientists from Stanford and Tokyo University with the help of CRISPR have bred pigs for growing human organs. Although this method (xenotransplantation) is in the process of being developed and tested, it is already quite advanced.

During the experiment, scientists genetically modify the fertilized egg of a pig

in such a way that animals do not have pancreatic gland in the future, removing the cells responsible for it. After that, the embryo with the induced human stem cells is introduced into the uterus of the adult.

It is assumed that even with the successful result of the experiment, the use of this technology for complete transplantation of this organ will not work. However, it will be possible to transplant individual cells from the glands responsible for insulin regulation.

Organ printing

Technologies are developing rapidly and are gaining increasing interest in medicine. Therefore, the method of 3D printing began to use in medicine.

The method is embodied in a device known as a biological printer. Nowadays biological printers are coming out of the prototype and small-scale models are emerging. For example, Organovo's machine is capable of printing tissue fragments containing 20 or more cell layers (including cells of different types) united by an intercellular tissue and a network of blood capillaries.

The connective tissue and the cells are brought together by the following technology: the movable head moves with micron accuracy in a three-dimensional grid of coordinates, "spits out" into the desired point of droplets containing either cells or collagen and other substances. Various manufacturers of biological printers have reported that their devices are already capable of printing out fragments of the skin of experimental animals, as well as elements of the renal tissue. And as a result, we have managed to achieve the correct location of cells of different types relative to each other.

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TIDAL ENERGY

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Tidal energy has been used by humans for a long time in the form of inflow mills off the coast of the United Kingdom, France, Spain, Russia, Canada, the United States and other countries. Such installations were performed by the formation of a pool at the overlapping of the dams of small bays, which housed the wheels of the mills, rotating during the tide. Wheel diameters reach 6 m. In the UK, a similar installation under the arches of the London Bridge since 1580 has pumped fresh water for 250 years.

The mode of operation of the PES is characterized by the specific features associated with the cycling of tides. The PES generates electricity during the day interrupted by periods of tides, which, however, do not coincide with the peale hourly load of the grid in this regard; more efficient operation of PES in the power system can be achieved when installed on the turbine units, which allows you to better fit the cycle of PES in load schedule of the power system.

In the whole case, PES may also participate in the infantry covered load schedule.

Despite the large supply of tidal energy in addition to the huge cost of constructing a tidal power station, this energy has other downsides: if the nearest energy center, long and expensive transmission lines are required.

In addition, the production of tidal electricity is produced only at the beginning of the tide, that is, when the water level is collected in the bason, electricity production will decrease and fall to zero at the lower eff as the difference in the levels

disappears, and cyclical energy production does not meet the daily cycles of energy demand and must be offset by other sources.

Efficiency of use of powerful PES' renewable energy can be achieved in the conditions of combined systems when IPPS, NPPS are working together, so that during intermittent operation of PES in the daily cycle it can insure its optimal discharge in the schedule of load of the grid.

When operating tidal power plants in the grid, where there is an excess of electricity in the failure part of the load schedule, it is possible to use a single-base double-acting circuit with pumping pump, which requires the installation of circulating units. These units, while pumping during the failure of the load schedule, increase the volume of water in the pool and allow the increase of electricity output at low tide, producing additional volume at increased pressure.

The PES mode is characterized by specific inflow cycle features. PES generates electricity during the day intermittently during high tides, which, however, do not coincide with the peak in the daily grid load schedule. In this regard, more efficient operation of PES in power systems can be achieved by installing turbine facilities on them, which allows to better record the cycle of PES operation in the schedule of power system load. In this case, PES may also participate in covering the peak portion of the load schedule.

There are several technologies for producing tidal electricity:

• Tidal Generator – a generator of electricity that uses kinetic energy from water, similar to how windmills use wind energy.

Some of the tidal generators can be built into the bridge support without creating aesthetic problems. It is advisable to install such turbines in the ducts, where the flow rate of water increases. Tidal turbines can be vertical and horizontal, open or fairing.

• Tidal dams – technology that uses the potential energy of the difference in water levels during tides. Dams capture water during high tides and hold it. At low tide, water returns to the ocean, triggering turbine generators and generating electricity.

• Dynamic tidal power plant – new technology that uses the interaction of kinetic and potential flow of energy. It is planned to build a dam directly at the high seas, about 30-50 km long. As a result, all the masses of water will be accelerated in one direction. Generally low-pressure hydro turbines will generate electricity.

• Tidal lagoons – technology that involves the construction of circular dams with turbines. The created reservoirs are similar to those formed by tidal dams. The difference is that tidal lagoons are completely artificial objects and will not contain the ocean ecosystem.

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INNOVATIVE TECHNOLOGIES IN HEAT SUPPLY SYSTEMS

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It is not much of an exaggeration to say that we live in the world that materially and intellectually has been created by science. Science is one of the moving forces of society development. It is a very important sphere of human activity. Science provides the tools which help understand the world we live in

and helps us solve even everyday problems.

Nowadays, people in our country are worried about utility bills, especially in winter. Mostly we spend a lot of money on gas and warm water. Therefore, as can be understood from the title of the report, it is about innovative technologies that exist today in the sphere of heat supply; and some pieces of advice how to pay less for utilities are provided.

First of all, you have to monitor the condition of the heating system in your house. Because all kinds of overgrowing and scale on the internal walls of heat network devices entail significant financial costs. The throughput of pipes decreases sharply, respectively, the costs for electricity needed to maintain the required temperature increases.

Today, washing the heating networks with a hydrodynamic method is very popular. It consists of softening the coating, destroying them and removing them from the pipelines. Water and air are supplied under pressure in the working area with a flushing pump and circulate in it for a certain time. Due to turbulence, deposits are loosening up and are carried by a water-air flow.

Thermostatic valves. Modern heating systems can be called those that are equipped with this small device. When the room is overheated, the thermostat stops or reduces the access of warm water to the heating system. So, water enters the system of the neighboring room, and if this room overheats, then its thermostat will also be closed. Thus, excess coolant is excluded from the circulation.

And most importantly, this device (the heat pump) helps you to reduce a significant part of utility costs. Heat pumps are compact heating units designed for autonomous heating and supplying warm water to residential and industrial premises. They are environmentally friendly, as they work without burning fuel, do not produce harmful emissions in the atmosphere and also extremely economical, because they can convert 1kW of electric energy to 3-4 kW of thermal energy. Using of heat pumps instead of traditionally used sources of thermal energy has a lot of advantages, because there is no need to purchase, transport, or store fuel; the installation does not spoil the interior, as there is no

indoor or outdoor unit, and it takes up a minimum of space.

Heat pumps are not cheap equipment. The price of a geothermal heat pump is calculated from 300-400 USD per 1 kW of thermal power. However, if operating costs are considered, the initial investment in geothermal heating, cooling and hot water supplying quickly pays off due to energy saving. In addition, it must be borne in mind that during heat pump work, no additional communications are required, except for the household electrical network.

Summing up, it should be said that everybody does not have to save money in their wallets and pockets, but everybody has to save our planet, water, air, soil etc. So, using environment-friendly and energy-saving devices we will get a chance to make our planet better. There is hope that scientists or students of KPI will develop new methods of energy saving in the near future because scientists never stop at the accomplished. They go on thinking of new inventions and making new discoveries. Our task is to use them reasonably.

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ENERGY SAVING TECHNOLOGIES

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Today, energy conservation is one of the key position in the development and

economy of consumer services and materials markets. Use of alternative energy sources is becoming increasingly popular. Solar cells, combined with the use of wind turbines, can act as both an additional and a primary source of energy, thus relieving the consumer from acute dependence on centralized energy networks. Consumption of other fuels and energy is reduced.

Energy-saving technologies are able to minimize unnecessary energy loss, which is now one of the priority areas not only at the state. This is due to the scarcity of major energy resources, the rising cost of their production, and global environmental issues.

The introduction of energy-saving technologies into the business activities of both businesses and individuals at the household level is one of the important steps in addressing many environmental problems - climate change, atmospheric pollution, resource depletion and others (World energy saving experience, 2019).

Energy saving is the efficient use of energy through the use of innovative solutions that are technically feasible, economically viable, environmentally and socially acceptable, and do not change the habitual lifestyle.

Conventionally, modern energy-saving technologies can be divided into several types, depending on the field of application:

- Energy-saving technologies in production;
- Energy-saving technologies in transport;
- Energy saving technologies for individual consumption;
- Energy-saving technologies for general consumption.

Main directions and ways of energy saving:

- Saving of electric energy (lighting, electric drive, electric heaters and hotplates, refrigeration units and air conditioners, consumption of household and industrial devices, reduction of losses in the electricity grid);
- Heat savings (reduction of heat losses, increase of efficiency of heat supply systems);
- Water savings (water intake, consumption at home and at work, reduction of losses and increase of efficiency of water supply systems);

- Gas savings (consumption at home and at production, reduction of losses and increase of efficiency of gas supply systems);

- Fuel economy (reduction of consumption in internal combustion engines, alternative types and hybrid systems, reduction of losses and increase of efficiency of production of electric and thermal energy) (Energy saving technologies. Energy saving, 2019).

Energy conservation is a very important task of conserving natural resources.

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ENERGY RESOURCES OF THE FUTURE

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The profession of an electrical engineer is an important one now and will be in the future. Every day, we use electrical devices. Everything around us works on electrical sources. The humanity is switching to alternative energy sources. Mining deposits extraction, from which electricity is produced, is very inconvenient and hurts the environment. Electrical engineers try to find new alternative energy sources because the conventional ones will end in the next 50 years. Electrical engineers have succeeded in developing alternative energy sources in few countries.

One of these countries is Costa Rica which reached 99% of electricity generation from renewable sources last year. It is also worth noting that this year the country has been supplied with "green" energy for 100%. For energy production, the country uses mainly water environment but it has other renewable sources. Costa Rica is rich in water resources: it is washed by the Pacific Ocean and the Caribbean

Sea on both sides, it has many mountain rivers, and the coast is blown up by powerful winds.

Fantasy of electric engineers has no boundaries. They built hydroelectric a power station on the west coast of South America in the Atacama Desert, which is the driest place on earth. It is a hybrid of solar and hydroelectric power stations, as well as a huge solar energy storage. Water power plant will pump water from the Pacific into huge reservoirs with the help of special pumps. After that water goes down and puts turbines in motion, which, in turn, will again start producing electricity.

Alternative energy sources are used not only in ordinary life. This energy can be used in light- and heavy industries. China successfully does it. This country takes first place in mining alternative energy sources from powerful winds. This was done to reduce the price of manufactured goods in the world market.

Greenland uses the energy of the mountains. They are pumping water into the volcano. Water turns into steam. This steam is pumped into special turbines located in the mountain. After that, this steam turns into electrical energy. Greenland can, with the help of this energy, heat all houses on its territory.

Electrical engineers have found many ways to extract electricity, but in the future, their number will become even bigger and they will be safe for humanity and nature.

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GLOBAL WARMING

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Our planet is approximately 4.5 billion years of age. For all the period of its existence the climate had been changing, but only under the influence of natural factors. Human activity had an enormous impact on Earth's climate and was the reason that in the last fifty years the situation has drastically changed but sadly not for the better.

There are a lot of factors that caused global warming but the main one is a greenhouse effect. It is caused by excessive amounts of these three gases in the atmosphere: CO_2, released by burning fossil fuel, emitted by factories and cars, CH_4, emitted from garbage dumps and by animals during grass digestion and N_2O, emitted from fertilizers. As a result, sun rays, that reflect from the Earth's surface, cannot return back into space because of the layer of greenhouse gases. Consequently, the temperature on the planet increases which leads to global warming.

Climate changes cause melting of glaciers and increase of the global sea levels. Therefore, a lot of coastal cities, including a lot of Ukrainian ones, could be submerged under water. Humanity is threatened to face various diseases, poverty and hunger as crops can easily be destroyed by natural disasters such as floods, droughts, earth quakes and hurricanes, caused by global warming. Also, it is the reason of forest fires all over planet. The world is currently 1°C warmer than preindustrial levels (Watts, 2018). Bottom line: Going above 1.5 degrees of warming puts millions

more at risk of potentially life-threatening heatwaves and poverty. It all but wipes out coral reefs that entire ecosystems rely on worldwide. Seas swallow even more of our cities. And that's just for starters ("Why is 1.5 degrees," 2019). We have to act immediately in order to save our planet. First of all, people must reduce CO_2 emissions, replacing fossil fuels with renewable sources of energy. There are also some other ways to do it. The first one is transforming CO_2 into fertilizers. Huge exhausters collect carbon dioxide from air which is supplied to greenhouses. Another one is to mix gas with water and store it underground.

In conclusion, global warming is a serious problem that has to be solved, otherwise we will destroy our planet. Earth is our common home so everyone has to do something to maintain it.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Artificial intelligence is a unique product of technological progress. It enables machines to learn using human and personal experience, to adapt to new conditions, perform multifaceted tasks eatlier intended only for humans, to anticipate events and optimize the resources of various origin.

The concept of artificial intelligence is very interesting because it can greatly

simplify people's lives, since some of the work can be done by artificial intelligence . This will allow people to distract from the little things and focus the work of humanity on solving important issues. Artificial intelligence is already used in various fields, such as medicine, industry and agriculture and in everyday life.

We can also focus on the creation of superintelligence, which will help to solve important issues. To do this, we must teach it all the information already known to human beings in the field in which we seek to achieve unprecedented success. This could simplify the various calculations for the construction of different houses, spacecrafts, and the calculation of flight routes to another planet. This will help us move to a new stage of development and start building our space civilization.

Now there are computers that calculate and predict what threats our planet, can have, if people teach that computers to analyze the threats, then they can also get ways to eliminate the threat. But artificial intelligence itself can be a threat if given too much power. Because it can try to access all the information resources and become too powerful in the modern automatied of society.

It is believed that artificial intelligence may be the last invention of mankind. For this to happen, even one state would be enough to give artificial intelligence the right to violence (Pavel Kantyshev 2016 https://www.vedomosti.ru/technology/).

So, artificial intelligence is a very good way to accelerate human development, but people have to be careful with this new tool. Having created machines, we have ceased to evolve physically, so we must not lose our greatest value. This value is the ability to think. This brought us to the power of our species.

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COMMERCIAL APPLICATION OF CARBON DIOXIDE PROCESSING TECHNOLOGIES

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The problem of carbon dioxide emissions is one of the mankind's biggest problems. Businesses are emitting more and more carbon dioxide every year, which causes ozone holes and ozone depletion as a whole. Therefore, addressing climate change requires immediate action to reduce carbon dioxide. This is a difficult task that has no immediate solution, which is why methods based on obtaining carbon dioxide from the atmosphere are attracting the attention of scientists.

Combining them with commercial products and profit generates a positive economic incentive for businesses. As a result, the effectiveness of these measures will be much higher compared to negative incentives such as the carbon tax.

Canadian startup CleanO2 was created basing on this principle. The company has built and manufactured a CARBiNX device that captures carbon dioxide from the emissions of industrial plants or other sites where hydrocarbons are combusted and CO2 is produced, for example, in boiler rooms. The carbon dioxide that traps the device is converted to potassium carbonate and subsequently used to produce soaps, laundry detergents and other products for the cosmetic and agricultural industries. One of CleanO2's clients is the well-known company LUSH Cosmetics, which uses potassium carbonate in its production.

The dimensions of CARBiNX are comparable to the size of two household refrigerators. The machine captures carbon dioxide on the gas, using hydroxides to absorb it. The reaction results in water and potassium carbonate. Revenue from its implementation is shared between CleanO2 and the device owner. According to the company, the acquisition of CARBiNX pays off in 4-5 years. An additional advantage is the heat release during the chemical reaction. It can be used to reduce energy consumption, for example, to bring homes into the heating and hot water

systems.

Currently, there are 14 CARBiNX devices in the Canadian provinces of Alberta and British Columbia, which can absorb up to 6 tonnes of carbon dioxide per year. The company intends to install 40 more devices by the end of this year and reach 1,000 units in a year.

These efforts are not yet able to solve the problem of CO2 emissions, they remain only a small step along the way. However, over time, the effect of them will add up and be more noticeable.

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ARTIFICIAL INTELLIGENCE - FORCE FOR PROGRESS AND ITS ADVANTAGES

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The scientific and technological revolution has made fundamental changes in our world. Because of rapid technology progress humanity, in its pursuit to get necessary life conditions through trying to harness nature, has caused serious damage to the environment.

According to many scientists, it was the process of technological revolution that finally highlighted a human being in the whole circle of existence. Thanks to technological progress, human proves his supremacy over the other types of living beings. Today mankind has almost reached the maximal modern technological level by starting the development of artificial intelligence, and it increasingly affects different social domains and spheres of life.

A few centuries earlier, a man tried to simplify his life by replacing physical labor with machine labor and speeding up the production processes. As a result, were created airplanes, cars, radio and television, means of wireless communications, missiles, equipment at factories and much more.

And then, finally, technological progress has reached the phase of development when something which had seemed impossible became possible. Nowadays we are going ahead to the replacement of human mind. Artificial intelligence is created with the aim to recreate and reproduce human mental labor. And, once again, this is done to attain even greater efficiency of the production processes.

Experts are sure that in the upcoming years we can expect sharply increasing rate of AI-technologies development; their application will be more common and widely spread: from small and medium businesses to a variety of industrial enterprises. For example, according to preliminary data from Gartner, the global AI-technology market was amounted to $1.2 trillion in 2018, and by 2022 it will have grown to $3.9 trillion (1).

The development of artificial intelligence is fundamentally changing the business environment. The market requires more efficient resource management, and computer intelligence helps to achieve this goal. AI already successfully manages functions such as: error analysis, data classification, pattern recognition, it predicts analytics and helps to accelerate business processes (from simple optimization of supply chains to biochemical modeling, AI allows to reduce the cycles of the invention and development of drugs).

According to the new study conducted by the McKinsey Global Institute (MGI for short), AI can significantly increase overall economic productivity in the nearest future. Even taking into account the costs of the transition period and the consequences for competition, by 2030, AI can add about $13 trillion to total output and about 1.2% to the annual growth rate of world GDP. This growth is comparable with the economic effect made by previous technologies, for example, steam engines in the 1800s, industrial production revolution in the 1900s, and information technology implementation in the 2000s (2).

Probably the most discussed issue related to AI is that a great number of job positions can be replaced by intelligent machines. But as it turned out during the MGI study, the transition to AI may not have a significant impact on net employment in a long run. Additional investment in this knowledge branch will even increase employment by 5% by 2030, while additionally created wealth would increase the demand for labor and consequently employment will increase by another 12%.

How do we see the future? Authors of science fiction novels predict more pessimistic rather than optimistic scenarios of the future, perhaps because this allows them to compose more fascinating stories. But it seems that artificial intelligence is developing on the same principle as the other revolutionary technologies (printing, engineering equipment, aeronautics, telephony, etc.).

In conclusion, it is worth noting that the key factor determining the development of AI technologies today is the growing rate of the computing power of machines, but the principles of the human psyche are still unclear (at the level of detail available for computer modeling). Therefore, the topic of AI conferences looks quite standard and in terms of composition have not changed for quite long time. But the increase in productivity of modern computers, combined with the rise of algorithms quality periodically makes it possible to adopt various scientific methods in practice. It happened with intellectual toys previously and it is happening with home robots nowadays.

It should also be noted that in its short history, artificial intelligence has achieved significant success, but the last statement from Alan Turing's essay "Computing Engineering and Intelligence" today remains undeniable. It reads as: “We can only look ahead at a very short distance, but we can still see how much remains to be done”.

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SOLUTIONS TO GLOBAL WARMING PROBLEMS

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Global warming is a very topical subject right now. Each year, the temperature exceeds the previous mark and the level of the oceans is becoming higher and higher. Matt McGrath (2019) reports that "the signs and impacts of global warming are speeding up" and "global temperatures have risen by 1.1 degrees C since 1850, the paper notes they have gone up by 0.2C between 2011 and 2015". As a consequence, we observe massive forest fires, melting glaciers, deadly hurricanes, and droughts. The impacts of global warming are very dangerous. If people do not stop harming nature, it will have an irreversible impact on the whole planet.

Changes will also occur in human health. The percentage of diseases is likely to increase. Climate change can lead to new diseases and the negative progression of already known ones. There is nothing positive about this problem, but it's not too late.

So what can be done?

In my opinion, it is necessary to reduce the number of cars that are used. People should also start using green energy to solve the problem. That is, using alternative sources of energy. Another step is to reduce the scale of deforestation. Deforestation affects the CO_2 balance that pollutes our air. The destruction of trees contributes to the greenhouse effect, which affects the climate negatively.

As for each of us, we can start doing simple things, which will greatly affect the solution to the problem.

- You can start with lighting. Change the lighting in your home to energy-efficient.

- Take a shower instead of a bath (you'll use much less water).
- If it is possible, compost organic waste.
- Plant trees in your yard. It will enrich "the lungs" of the planet.
- Refuse using cars in at least some cases. Such as going to work in public transport.
- Use fewer plastic bags as this will pollute the environment.

There are many examples of what can be done. In my opinion, the main thing is to understand that you need to do something.

Put it into a few words we can say - everything is in our hands!

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GLOBAL WARMING

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The problem of global warming is now very important, as it is a threat to the entire population. Global warming is an observed fact about an increase in the temperature of the Earth's climate system for an indefinite period. The term "global warming" is often used to denote the increase in average air temperature at the surface of the land and ocean.

The air temperature since 1850, on a ten-year scale, has been higher in every decade than in any previous decade. The scientific community argues that the causes of climate change with an almost one hundred percent degree of certainty are associated with human activities. Rising sea levels, changes in the amount and nature of precipitation, increasing deserts are the results of rising global temperatures.

Global warming is the most noticeable in the Arctic, it leads to permafrost and the retreat of glaciers. Other effects of global warming: extinction of species due to temperature changes, ocean acidification, increased frequency of extreme weather events, including droughts and rainfall. Important consequences for humanity: a threat to food security due to a negative impact on productivity (especially in Asia and Africa) and loss of human habitat due to rising sea levels.

Climate changes caused by greenhouse gases in the first half of the 20th century influenced the development of plants, in particular, at the beginning of the 20th century, the risk of drought increased on a global scale. The climate system responds to changes in external influences. Some examples of such effects are: a change in the atmospheric gas composition (a change in the concentration of greenhouse gases), volcanic eruptions, changes in the orbital motion of the Earth around the Sun (Serov, 2010).

One of the most visible processes associated with global warming is the melting of glaciers. Over the past half century, temperatures in southwest Antarctica, on the Antarctic Peninsula, have increased by 2.5 ° C. The mass of Antarctic ice is decreasing at an accelerating pace. However, the area of Antarctic glaciation is growing. The acceleration of permafrost degradation has been noted.

According to Mikhail Serov (2010), it is possible to rectify the situation only with the help of the state administration of the most relevant climate research. I also agree with the opinion of the British writer, historian and environmental activist J. Neal (2010) that the transition of humanity to a low-carbon economy based on renewable energy sources is necessary, but this requires decisive action on the part of civil society, as well as serious political and economic changes in the world.

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TACKLING THE ISSUE OF WASTE CRISIS

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According to a study by the Eurostat agency, in recent years, the amount of garbage generated on average in the EU has been gradually increasing, despite Brussels' growing awareness and struggle with waste. In 2017 the amount of waste generated in the EU amounted to 249.238 tons (or an average of 487 kg per capita). For comparison, in 2013, Europeans "litter" constituted 242.195 tons (or 479 kg per person), according to data released by the European Statistical Office on January 23.

Hundreds of thousands of tons of household waste are collected annually in urban landfills of even a medium-sized city. When decomposed, it poisons air, soil, groundwater and is thus transformed into serious danger to the environment and humans. That is why the "heroes of the day" are effective, waste-free, and most importantly – environmentally friendly technologies for industrial waste recycling. These include modern incineration plants capable of neutralizing and disposing of household waste and simultaneously generating heat and electricity, thereby offsetting the considerable costs of the processing itself.

In economically developed countries, less and less household waste is disposed of in landfills and recycled more and more by industrial methods. The most effective of them is thermal. It allows you to reduce by almost 10 times the amount of waste disposed of in landfills, and the unburned residue no longer contains organic substances that cause decay, spontaneous combustion and the risk of epidemics. Nowadays foreign experts rely on waste incinerators, which not only burn waste but also process the heat generated in this process into energy. Nevertheless, in most countries, the generation and utilization of heat and electricity are considered only as an addition to the disposal of waste.

Combustion in a grate is considered the most common technology. Most foreign waste incinerators operate according to this method. Waste incineration in

fluidized bed furnaces is widespread in Japan. In Europe there are only two such plants – in Spain and Germany, two more are being built in France and Russia (Moscow). A circulating fluidized bed incinerator operates in the United States. Unfortunately, both of these technologies do not solve the problem of utilization and neutralization of solid residues – slag and especially fly ash, which is captured by the gas treatment system.

The burning of polymeric materials containing chlorine is inevitably accompanied by the appearance in the flue gases of chlorine-containing toxic components – dioxins and furans. Sources of dioxins and furans are not only emergency situations at chemical enterprises. These toxic substances are formed under normal conditions during the burning of wood, waste, diesel fuel, copper smelting, pulp production, in cement kilns and other (especially chemical) industries.

If the factory technology is strictly observed, the concentration of chlorine-containing toxic components in flue gases falls to the lowest standard values adopted in European countries, and now in Moscow. In other words, in contrast to landfill during landfill incineration at a plant, one can not only control their quantity and environmental impact but, very importantly, manage this process.

The incinerator built in 1997 in the German city of Würth is not accidentally called an enterprise of the 21st century. It was the first time on an industrial scale that the combined technology of the German company Siemens was used. A practically non-waste and environmentally friendly process takes place in two stages: first, the waste is exposed to relatively low temperatures (up to 400 C), and then their high-temperature burning (1300 C) takes place. As a result, up to 90% of the waste is completely burnt, and the remaining 10%, the so-called solid residue, turns into materials suitable for use without any additional processing: non-ferrous (non-magnetic) metals, mainly aluminum, magnetic metals – steel and cast iron, stones, glass, ceramics, and granular slag. Only 0.3% of the initial volume of waste must be disposed of in landfills. The flue gases emitted during the burning of waste gases pass through a multi-stage gas purification system and contain much less harmful substances than is provided for by the most stringent European standards, and heat is

processed into electric energy or used for heat supply needs.

As for the specific steps that each of us can take to reduce the amount of waste, Pierre Condamine advises buying goods in stores in bulk to avoid useless packaging, handing glass containers and bringing a food container to the store in case you buy take-away food. According to the expert, buying used things and electronics – instead of buying everything new – is also a good way to minimize the amount of discarded items.

Currently, incineration is one of the most common methods of waste disposal. But garbage production is growing. Thus, each of us should already reduce the volume of waste.

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VIRTUAL REALITY IN AUTOMATION

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Safety, training, productivity and efficiency are key factors for optimal performance. Among technologies that improve these areas are virtual reality (VR) and augmented reality (AR). They are gaining momentum for their advantages, and also provide savings.

One of the main tasks of training based on simulation is to reduce the time spent on transferring skills and knowledge of a high level, as well as situational awareness to each employee with maximum efficiency. Immersive training systems (ITS) using VR technology put employees at the epicenter of what is happening in order to get the necessary equipment management and maintenance methods. The

technology is highly scalable and provides benefits for everything from exploring a single piece of equipment to an entire enterprise, especially using highly realistic three-dimensional process simulations.

Realistic and detailed learning environments help you get to know the company and its work well before you appear live for the first time. In a VR environment for training or design, users interact with virtual worlds using a number of hardware devices, such as joysticks or virtual reality gloves. Immersion technology provides a similar gaming experience which attracts the younger generation. This allows him to assimilate information in the usual manner.

Enterprises represent a hazardous environment and they are constantly working. Because of this, training on real equipment is difficult to organize, especially when it comes to emergency situations. VR allows operators to be trained and evaluated in a safe and controlled environment, providing freedom and protection from risk.

VR technology has become functional and affordable thanks to the ability to model complex tasks that require adaptive thinking and real skills. Therefore, they are an ideal tool for learning in the digital age.

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ENERGY CONVERSION

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Everyone knows that energy conversion is the process of changing energy from one form to another. The example which you can see every day is turning on the light in the room, it is conversion of electrical energy into heat.

One of the most widely used form of energy today is electrical energy. It is easy to transfer electricity over long distances, to accumulate it and store, so we can produce it one time and use it some time later. The exact opposite is electric motor, it converts the electrical energy to mechanical energy, it is hard to transfer over long distances and impossible to store.

One of the most interesting examples today is conversion solar energy to electrical energy. Solar power is one of the cleanest form of energy available. It is one of the renewable energy source. This electricity can be used to supply renewable energy to your needs (Philip Kosky, Robert Balmer, George Wise, 2013, p.342)

All transformations of energy are subject to the First Law of Thermodynamics. The law says us that no energy disappears, but only passes from one form to another. We must not forget that the conversion of energy never occurs completely, because of part of the energy is spent on heating, such as when converting the mechanical energy of rotation of the generator shaft into electrical energy. Part of the energy is lost, these losses are mainly undesirable. All forms of energy degrade to heat, this is one statement of the Second Law of Thermodynamics (Rex Wailes, 1948, p.58)

The existence of undesirable energy losses is characterized by a coefficient of performance. Efficiency is defined as the relation of useful energy to its total amount.

One thing we must always remember. It is the problem of pollution into the environment during the conversion of energy in factories. It is one of the urgent problems today, we have to invent the alternative energy sources for minimize this problem. With understanding this problem people invented alternative power sources

as solar power plants, wind power plants etc. In today's world, people must improve these sources and use them everywhere for to save the planet.

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CREATIVE ADVERSARIAL NETWORK

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In the 21st century, not only people but also computers can do art. About two years ago, CAN was developed in the Artificial Intelligence Laboratory of Rutgers University. This neural network can create masterpieces of art based on many analyzed examples (Elgammal et al., 2017, p. 2). The operating principle of CAN is somewhat similar to its predecessor GAN. However, the mechanism is more perfect.

Let's understand what GAN is — this is one type of neural network, which consists of two parts. The first is a generator that creates new objects based on certain previously studied examples. The second part is the discriminator. It determines how much the created object corresponds to the studied examples and gives the corresponding signal to the generator.

The way GAN works is like a zero-sum game. In short, the success of one part is possible with the failure of the second. With each next signal from the discriminator, the generator creates an object that is more and more consistent with the examples (Karpathy et al., 2016). If we talk about fine art, it means that the created image will more and more resemble the proposed ones in style and composition.

When developing a new version of the neural network, the authors took into account the masterpiece creation model proposed by the psychologist Colin

Martindale. According to his theory, the artist's main mission is to evoke or influence the emotions of those who perceive an object of art, namely to bring them into a state of emotional arousal. This state is influenced by various factors, for example, the uniqueness of an object, the presence of a double meaning, its conceptual complexity.

Martindale paid particular attention to habits in influencing emotions. He argued that with the repeated repetition of similar elements, ideas, and tricks, the audience's interest in the work would gradually fade away. That is why ability to combine different styles and, moreover, add something of your own - is a very important element.

CAN is a neural network programmed to create a new unique formation. Now it creates objects based on the examples of more than 81 thousand works of art.

The main difference between the work of CAN and GAN is that the discriminator gives the generator not one, but two signals. The first establishes whether the created object should relate to images of art from these examples. The second signal gives information about how close the image is to a particular style. The operation is successful if the discriminator has attributed the image to works of art, but could not determine the style.

CAN, unlike GAN, is capable of creating a large number of unique masterpieces. Images created by CAN have been shown to various people. The task of people was to determine whether the picture was created by a person or artificial intelligence and evaluate from 1 to 5 how much they like the picture. 7 out of 10 people claimed that the picture was created by man and rated an average of 4 points. The creators of the network concluded that it is much cooler and more effective than its predecessor (Elgammal et al., 2017, p. 15-16).

The computer has long been able to imitate man-made works of art. The innovation of this neural network is in the ability to create something new, which has its own aesthetic value.

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GENERATORS

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THE PRINCIPLES OF OPERATION OF THE SIMPLEST DC GENERATOR

When the frame rotates around its axis, its left and right halves cyclically pass near the South or North pole of the magnets. In them, each time there is a change in the direction of currents to the opposite so that at each pole, they flow in one direction.

In order to create a direct current in the output circuit, a half-ring for each half of the winding is created on the collector node. Adjacent to the ring brushes remove the potential only of its sign: positive or negative. Since the semicircle of the rotating frame is open, moments are created in it when the current reaches the maximum value or is absent. To maintain not only the direction, but also a constant value of the generated voltage, the frame is made by specially prepared technology: it uses not one turn, but several, depending on the magnitude of the planned voltage; the number of frames is not limited to one instance: they try to make enough to optimally maintain voltage drops at the same level. Design features of DC generators. The main elements of the device are:

- external power frame;
- magnetic pole;

- stator;

- rotating rotor;

- switching unit with brushes.

According to the type of primary engine, the generators are:

- a turbine generator (an electric generator driven by a steam turbine or gas turbine engine);

- a hydrogenerator (an electric generator driven by a hydraulic turbine);

- a diesel generator (an electric generator driven by a diesel engine);

- a wind generator (an electric generator that converts kinetic wind energy into electricity).

The main scope of the DC generators is at factories, construction sites, enterprises of metallurgical and electrochemical industry, in locomotives and ships, for electric welding in the construction of synchronous machines, etc. Prefer devices that produce direct current are favoured because of their compact size and high-reliability simple circuit that allows you to increase their lifetime. In urban electric transport (trams and trolleybuses) traction generators are used, working as motors and DC generators. Low-voltage generators are suitable for lighting aircrafts, trains and cars, as well as for charging batteries. In some cases, DC machines are used as tachogenerators, inductors for insulation testing, in blasting as elements of ignition machines. DC generators are widely used in installations such as motor-generator to convert AC to DC for the ultimate purpose of powering electric motors and other needs in the factory and in laboratories.

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RADICAL INVENTION IN THE FIELD OF ELECTRIC TRANSPORT

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In today's world, long-distance transportation of perishable freight is required more and more often. Traditionally, we use refrigerated trucks for this purpose, but it causes harm to nature through harmful emissions. The thing is that being on the road for several days drivers have to stop the vehicle, take a break and have some rest. However, they do not switch the refrigerator's motor off so that the goods would not get spoiled. This project is aimed at building a solar-powered refrigerator, thus reducing or completely eliminating harmful emissions.

A refrigerator trailer operating on solar cells will revolutionize science and technology, making it easier to transport goods for long distances and save a lot of money. This vehicle combines the system of regenerative breaking, when kinetic energy is recovered by an electric motor, and electric storage batteries.

Regenerative braking is an energy recovery mechanism that slows a vehicle by converting its kinetic energy into electricity to be used immediately, or to be stored in the batteries. The use of the recuperative braking system maximizes the impact of every battery charge and increases the fuel economy of the vehicle (Adib, 2017; Mcintosh, 2019). However, the efficiency of the regenerative braking system decreases at low speeds. Therefore, traditional friction brakes are used to stop the car completely. The combined action of both kinds of braking systems is controlled by electronics.

A separate electronic control unit performs the following functions:

• speed control of rotation of wheels;

• maintaining the brake torque at the level necessary to slow down the vehicle;

• redistribution of the braking force between the recuperative braking system and the friction braking system;

• maintaining torque at the level required to charge the battery.

In this type of braking system there is no firm connection between the brake pedal and brake shoes. The selection of the intensity and method of braking is made by the control system based on the analysis of the driver's actions and the nature of vehicle's movement. The recuperative braking system also interacts with the anti-lock braking system, the brake force distribution system, the track resistance system, the emergency braking amplifier, etc.

What is more, under adverse weather conditions, the vehicle's battery can be recharged from the socket, and most refrigerator move along the road where you can easily find the charging sockets.

It is true that this type of electric vehicle can be rather expensive, but in the long run it will pay back. All in all, the inventions like this will certainly reduce transport emissions and bring much benefit to the environment.

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HARMONICS

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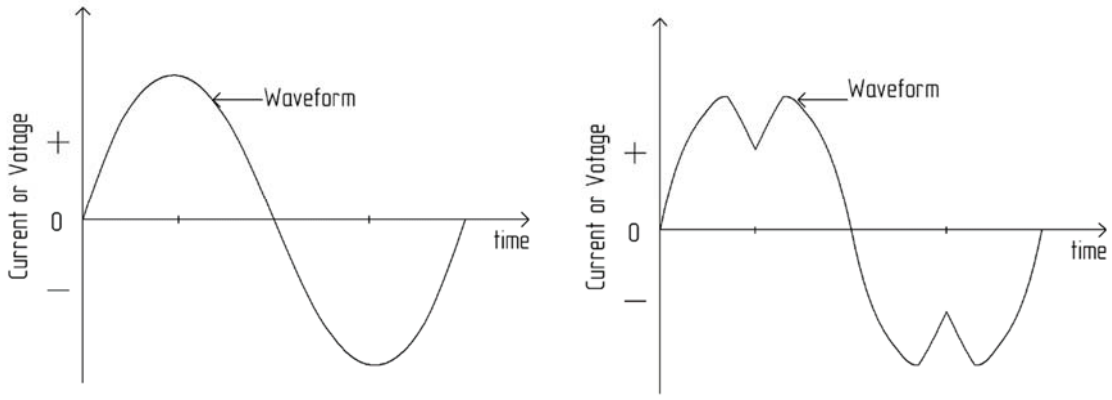
Harmonics are sine waves summing up with a (fundamental) frequency of 50 Hz (1st harmonic = 50 Hz, 5th harmonic = 250 Hz). Any complex form of a sinusoidal can be decomposed into frequency components, so the complex sinusoidal is the sum of a certain number of even or odd harmonics with smaller or larger

values.

Also, harmonics — there are continuous perturbations or distortions in the electrical network, having various sources and manifestations such as pulses, phase imbalances, surges and dips, which can be categorized as transient perturbations. An ideal sine wave should have zero harmonic components.



Waveform on the left does not have any harmonic components and is essentially a pure waveform with a linear load. Linear loads draw a sinusoidal current. So, they generally do not distort the waveform nonlinear loads. However, can draw current that is not perfectly sinusoidal as shown in the figure on the right, since the current waveform deviates from a sinusoidal wave, voltage waveform distortions are created. Waveform distortions can drastically alter the shape of the sinusoidal waveform. It's actually just a composite of multiple waveforms called harmonics. Here we have waveforms that show how the harmonic components combined to form a resultant waveform with much distortion the graph. On the left shows the fundamental frequency waveform combined with that of the fifth harmonic and seventh harmonic waveforms to form the graph on the right. We have a nonlinear waveform that shows clipping this type of waveform is common in electronic devices having nonlinear characteristics such as computer based equipment. When the sine waves are distorted symmetrically about their average values then they're composed of odd harmonics (Veeravalli, 2015, p. 1).

The problem of non-sinusoidality arose recently in connection with the use of powerful electric receivers with non-linear current-voltage characteristics, such as electric welding, arc steel-smelting furnaces, uncontrollable and, especially,

controlled valve converters. At present, the problem of higher harmonics is one of the important parts of the general problem of electromagnetic compatibility of power receivers with a power supply network.

The non-sinusoidal current in the resistances of the supply network creates non-sinusoidal voltage drops so that even with a sinusoidal EMF of an energy source in a network with a rectifying load, non-sinusoidal currents and voltages. Thus, the load consumes a distorted current from the supply network, which includes harmonics, with frequencies exceeding the fundamental frequency.

Voltage drops due to these currents cause distortion of the voltage curve power supply, which leads to additional loss of transmitted power, may interfere with the operation of other receivers, creates a risk of resonance and overload circuits containing capacitance. Therefore, the rectifying load can be considered as a generator of higher harmonic voltages.

When passing currents of higher harmonics through the elements of the system additional losses of active power occur and electricity. The greatest additional losses of active power occur in transformers, motors and generators. In a number, cases these losses can lead to unacceptable overheating of the windings electrical machines and in all cases lead to additional losses of electrical energy.

Higher harmonics of current and voltage affect errors electrical appliances. In the practice of operation, an increase in the errors of induction counters of active and reactive energy is essential. The values of these errors are significantly reflected when taking into account the consumption of electric energy (Stepanov, Bazyl, 2013, p. 28).

The appearance of a loss from higher harmonics makes it necessary to reduce their levels in power supply systems. At present, the main measures to reduce the effect of higher voltage harmonics on electrical components are:

- rational construction of power supply schemes;

- the use of multiphase rectification schemes, special laws for controlling converters;

- the use of resonant filters.

An increase in the number of rectification phases is an effective measure lower levels of higher harmonics. However, anode transformers for numerous rectification phases are complex, expensive and unreliable. Therefore, for powerful converters, they are used as generally no more than 12-phase rectification mode.

One of the most promising ways to reduce currents and voltage of higher harmonics in the networks of industrial enterprises is the use of power filters of higher harmonics, representing a series connection of inductive and capacities resistances tuned to the resonance of the filtered harmonic.

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GLOBAL WARMING ISSUE

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Once being a distant, nowadays the concern of global climate change is concerned as a significant threat to human beings and the greatest challenge our generation has ever faced with. Global warming is a slow increase of the Earth's surface temperature, which, in its turn, is closely related to the greenhouse effect leading to climate changes all over the world.

More than 97% of environmentalists believe that the main cause of global climate changes and the consequent warming is human activities. It should be noticed that if the Earth's global temperature rises by 4◦C, the ocean level will rise by almost 9 meters, so that large coastal cities can go under the water for more than 100 years. One of the main reasons why this environmental problem occurs is carbon dioxide (CO2) production. Currently people produce large quantities of CO2 and over the last

hundred years, CO2 concentration has increased by 40%. Along with CO2 the concentration of methane (CH4) in the atmosphere increased 2.4 times compared to the pre-industrial period (Recent climate change trends, 2019).

Everyone should know that the global warming and all the accompanying processes have irreversible impacts on people's lives, the functioning of energy buildings, agriculture, industries, the animals' existence and reproduction and so on. Climate change also causes e typhoons, hurricanes, droughts, floods and even earthquakes. So we need to keep our planet safe working together, but everyone must start from him/herself!

I would like to conclude the paper with the words of Volodymyr Danilov, a famous Russian writer, who once said that our attitude to nature is not measured on a global scale, just taking into account only large forests, oceans and lands. There is always one little thing – our relation and attitude to a single tree, littering of the smallest stream or handful of fertile soil. Protecting one small thing, we keep the whole nature in safety.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Artificial intelligence is a unique product of technological advancement that enables machines to learn, using human and personal experience, to adapt to new conditions within their application, to perform multifaceted tasks that have long been human-only, to predict events and optimize resources of different nature.

Most examples of AI use, known today from chess computers to autonomous

robotic systems are still human-dependent and require deep learning. However, even at the stage of their current progress, they have a global impact on the life of the entire society, forming new ideas about the future and prospects for the development of cutting-edge technologies (Dolhopiatova, 2018).

The intellectual reality today involves widespread application practices and forms a number of promising areas for smart technology development.

AI technologies have been successfully applied in everyday life:

- Demand for smart home technologies is increasing every day around the world.
- Businesses and government structures combine to create smart cities.
- Scientists are massively testing intellectual assistants to create the perfect life for a person.
- Companies are developing hundreds of smart smartphone apps to help share information and solve day-to-day business.
- Every day, we communicate with the administrator jobs and the assistant jobs on the phone that answer our requests.
- We order goods online and receive parcels in post offices.

It is expected that by 2030, homework will become the norm, providing the most favorable living conditions, and technologies of “smart homes” will become the standard of quality living. Other trends, experts say, will exceed any expectations in the next decade, given the growing consumer demand for intellectual technology. The automation of basic life processes is a global perspective.

AI technologies are successfully applied in the field of education:

- Today’s schools use smart gadgets everywhere.
- Bulk online courses system is increasingly being used instead of lectures at universities where students often miss video lessons, interactive assignments and exercises, and more.
- Online learning is becoming more and more popular and effective every year because of the desire of many to combine work and study.

Distance Learning is a locomotive of modern high-tech education, which

requires distance examination. Proctoring systems keeping track of the student when writing test papers and passing exams ensure maximum transparency of the process. In the recent past, proctoring has suggested that they observe a student through a webcam during the entire exam.

In a number of countries, schools test electronic journals that provide parents with information about their child's online success and attendance and simplify paperwork for educators.

Existing systems are being actively developed and refined that determine the student's level of knowledge, evaluate the correctness of the answers and develop a personalized training program. Examples include well-known solutions such as SHERLOCK. The latter program is used by the US Air Force to train pilots.

It is expected that in the near future, machine learning will identify the ability of the person and give training recommendations, always being “at hand” through the app on a mobile device. Many scientists are relying on AI technology in the education field because of their impartiality in assessing knowledge and testing learning tasks. Moreover, British scientists predict that in the future, each person will have their own tutor.

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THE IMPACT OF TECHNOLOGICAL BREAKTHROUGHS

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In today’s rapidly changing world there are a lot of inventions that make our life easier. This phenomenon is called technological progress, and it dramatically

influences social and political life of our society.

According to the Cambridge dictionary, technological breakthrough can be viewed as an important change that has been caused by the outcomes of an invention, innovation, and combination of technology and development processes.

All of the well-known major inventions made by man were developed during the long history of humanity. As far as the practical value of new designs and concepts is concerned, I am prone to think that the most important period of innovations was in the past, where many things such as electricity, network, Internet and different means of transport were created. In fact, it would be difficult to imagine our present-day life without these basic inventions. To be honest, speaking of the inventions and discoveries of the present, I am a strong supporter of the claim that our modern technological breakthroughs greatly depend on our previous achievements. Today, scientists worldwide create devices that can control the functions within our houses and could substitute for people at work, or even replace human labour altogether in future. As a result, these days we have a lot of opportunities to communicate with people across the seas and boundaries, to study anything and anywhere we like, and to live in a comfortable environment.

It is hard to predict what life will be like in the future. If artificial intelligence is an important part of our life today, maybe in some decades or so it will rule the world and people will be controlled by it. On the other hand, we may be able to fly in the air instead of driving for hours to our workplace. Anyway, it is obvious that nowadays technological breakthroughs are progressing and changing the world we live in.

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ANOTHER WAY TO USE REMOTELY PILOTED AIRCRAFT

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It's no secret that the power grid, especially high-voltage wires, can be damaged and even worse (broken) . It is estimated that annual losses due to interruptions in the work of the network is 169 billion dollars. Earlier, people were looking for a wire break and it took a lot of time and effort.

Today, people have discovered such a wonderful invention as an unmanned aerial vehicle or shorter drone. According to a recent report, operational safety and advanced automation are two of the biggest challenges - and opportunities - in using drones for electric networks. Problem of operational safety is manifested in the fact that drones are equipped with collision avoidance features , but this features is not perfect. Especially when it comes to real-time workarounds .

A research team from Queensland University of Technology has developed a 20-month quick concept-verification program to describe and solve the problem with the regular use of drones (Harvey, 2018, p. 62). Controlling an remotely piloted aircraft near any object (and not collision with it) is a difficult task. But when it comes to the flight of these drones near power lines, this is an even more difficult task, since the pilot must accurately assess and control the location of the drone relative to the infrastructure. To solve the problem of automatic detection of problems in the network drones should be more autonomous and not so much dependent on the operator supervesing it. A team from Queensland University has made great progress in developing such a solution. They improved the sensors, which allowed for better collision avoidance. New technology for detecting and damaging wires has been developed be them.

Although these improvements have aggravated the work of the operators, however, the operator still remains in this chain of damage detection. The main purpose of these studies is to automate drones and improve their performance in the electricity world.

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USTYA RIVER WATER POLLUTION

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The Ustya river flows through the Rivne city center and divides it into two parts. The left side of the city is on a hill, so most of the recreation facilities near the river are located on the right side. The river has always been a center of attraction for citizens. There is a city beach, a hydropark, many cafes and restaurants. There were plans to build an open water park with attractions near the local lake using only river's water.

But the situation changed a few years ago when the entire river was covered with algae. Fish mortality has risen sharply and the flow of the river practically stopped. When the smell began to interfere with people who settled in a new residential complex near the banks of the river, the authorities began to clear the bottom of algae and silt. This helped partially restore the river flow for just one year. Already in the spring of next year the situation repeated itself.

A cleaning committee was established in the city. The committee determined the cause of the river pollution. This is an insufficient amount of oxygen in the water of the river due to the rapid growth and decay of algae.

But what caused such an active growth of underwater plants?

Research conducted in 2012 showed a 15-150-fold (seasonally dependent) increase in the concentration of nitrates in the river (Hruk, 2012). This happened as a result of the dumping of agricultural waste into the river from farms and small gardens, which are a huge number in the region (in the Rivne region, the ratio of rural

to urban population is 50 to 50, and this is one of the largest indicators in Ukraine).

Not surprisingly, nitrates affect algae growth in the same way as ordinary plants. The composition of special fertilizers for algae includes all the same nitrate compounds as potassium nitrate.

It is control over the discharge of waste into the river and a decrease in the concentration of nitrates that can help the city clean up the river. Cleaning the bottom can only help for a while.

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ECONOMY LIGHT BULB

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For over 100 years, people have been able to use bright lighting even in the dark. If the incandescent lamp used to be the assistant years ago, now the future is with new technologies. Economical, durable, safe and compact are significant advantages that make products increasingly popular. And among the areas of activity

one of the priority positions is occupied by LED lamps.

These energy-saving lamps allow saving up to 90% of electricity without losing light. At the level of lamps, LED lamps also play an important role. The power of luminaires is generally higher even compared to LED lamps; the LED lamp saves much more energy.

Throughout the world, this trend in lighting is now developing particularly rapidly. Soft scattered light, long service life and high economy are the main reasons why the LED lamp wins compared to other options.

The luminous flux of LED lamps is the amount of light emitted by the lamp. It is measured in special units – lumens. This figure is directly related to the power of LED lamps. Obviously, the greater the power of the lamp, the more light it emits.

The modern world does not stop at what has been achieved and moves on, refining the old, as well as developing the new. In our country was an inventor who has perfected the already needed invention. A 43-year-old businessman from Lutsk, Sergei Ivanov, invented a LED lamp that is twice as economical as its imported counterparts. According to the author of the invention, it is no secret that LEDs replace conventional incandescent lamps, consumes energy 10 times less and 50 times longer when working. At the same time, they do not require disposal as economical mercury lamps, since they do not contain harmful substances.

Ivanov's development, for which he spent more than an hour, is unique in that it does not need classic food and cooling, and it does not release condensate.

LED or light emitting diode is a semiconductor device with an electron-hole junction or metal-semiconductor contact that creates optical radiation when it is transmitted by electric current. When the electric current is passed through the pn-junction in the forward direction, the charge carriers – electrons and holes – recombine with the emission of photons (through the transition of electrons from one energy level to another). The light emitted lies in a narrow range of the spectrum, its spectral characteristics depend, among other things, on the chemical composition of the semiconductors used in it.

The main element of the LED is a crystal that converts electrical energy into

light. The crystal is grown on sapphire plates. In a special reactor, nitrogen gas is sprayed on the plate. They interact with each other to form a crystalline layer. After that, a protective layer and electrical contacts are applied to the plate with the grown crystals, gradually forming a LED chip. In the next step, the chip is placed in the housing and connected to external contacts, and then filled with epoxy gel or silicone. After these operations comes a LED that is already able to emit light, but it will be very unpleasantly blue. At the last stage, the LED chips are being covered with gel mixture containing phosphor, which allows turning blue light into white one of a certain shade.

The inventor believes that if all Ukrainians switched to such lamps, the saved electricity could be transferred to heating systems and not spent on expensive gas. The inventor patented the novelty and is ready for mass production. It is obvious that the future belongs to LED radiation sources because they have the highest energy efficiency among other sources and the absence of toxic waste, which makes them a potential substitute for previous analogues of artificial light.

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GLOBAL WARMING

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The theory of global warming is one of the most contradictory ones. The majority of scientists claims that it is real and is going to be the one of the most important problems on the Earth. However, some other researchers have the opposite opinion.

One expert called the theory of global warming as the greatest falsification in history. His name is Patrick Moore, one of the founders of the global environmental organization. He accuses politicians and government officials of bribing scientists and deceiving ordinary people. He also called the modern environmental movement as "a toxic mixture of ideology, politics and religion". According to his words, such shameless persons use trembling to control the human mind, and all talking about a growing climate catastrophe is a campaign of deterrence. People are blamed for "killing" the atmosphere that their posterity will need to breathe. First of all, children get under pressure. They are taught to believe in the danger of global warming by presenting incorrect facts and pointing to "smart scientists who explain the true order of things".

Moreover, Moore called carbon dioxide, which was declared as the main evil, "food for life", and not pollution of the atmosphere. Burning natural fuels, in which this gas is released, saves life on the Earth, supporting plants growth, but not destroys it.

So, Patrick Moore is a brave person, who is not afraid of western politicians. He protests against brainwashing Americans with the support of indifferent people and encourages not to accept all the words of government officials and so-called scientists for the faith, but to check the information by ourselves.

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ARTIFICIAL INTELIGENCE

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We live in the world where technology plays an important role in the life of each of us. Every day people make discoveries in the world of technologies in order to make our life easier. Now most companies are trying to develop the sphere of artificial Intelligence – AI. AI is used in a big number of devices from smartphones and TVs to robots and cars.

Artificial Intelligence is an area of computer science that allows computer or any other smart device to behave like a human. People use it for speech recognition, learning, planning and problem solving. Special bots and apps with Artificial Intelligence are being created in order to gather information from massages written by people who give them an ability to generate other massages on the bases of what they have learned. Unfortunately, there are also unsuccessful projects in this sphere. For example, chat bot Zo from Microsoft. After it was launched on twitter, it started talking about prohibited topics and was soon deleted. And it learned all this from people (Stuart-Ulin, 2019).

Artificial Intelligence in Ukraine is developing very fast. Ukraine is among top three countries with the number of companies in the sphere of Artificial Intelligence in the Eastern Europe. According to the report, in Ukraine there are 57 companies that operate in the field of AI. Only Poland (110) has more companies in the region (Demchenko, 2019). Our country also have special platform where everyone can find all the information about Artificial Intelligence. It helps ordinary people to keep

abreast of the latest news in this area.

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RENEWABLES: ADVANTAGES AND PROSPECTS OF USE

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Imagine our future where we will have clean urban air, the streets will be lit by solar energy and transport will no longer need gasoline.

All you have to do is to refuse the old stereotypical thinking and realize that new technologies shouldn't live apart from us. By refusing the transition to renewable energy sources (RES), we shift responsibility for solving current problems to future generations. The concept of "enough for our generation" can deprive our children of equal opportunities with the western neighbors, not taking into account the satisfaction with the nature we have. It is important to understand that the transition to renewable energy is a process that also requires decision of governmental lawmakers.

The fast climate change and the negative environmental and economic consequences of using traditional energy sources make the question of the need for change in the world energy. The transition to renewable energy is an effective

solution that can stabilize the situation with greenhouse gases emissions and give additional impulse to economic growth. In addition, such a transition could provide countries and regions with energy independence. Considering that in recent years, the renewable energy sector has seen a steady decrease in prices for solar, wind and other energy technologies, it is not surprising that global trends indicate a steady increase in the share of renewable energy sources (Sustainable Energy Outlook, 2018).

The main source of energy is the Sun. 30% of solar energy reaching the Earth is reflected back into space, 47% is spent on heating the Earth's surface, 22% on water cycle in nature, and only 0.03% is absorbed during photosynthesis. Owing to photosynthesis, we have the main forms of energy - fossil fuels and biomass. About 2 billionths of the Sun's energy is obtained by the Earth. The Earth absorbs about 1 billion terawatt-hours of solar energy per year. If we compare this value with the estimates of the energy contained in the explored reserves of natural gas, coal, oil, uranium, it will become clear that in one week the Earth receives from the Sun the amount of energy that is more than twice exceeds the amount of all known energy sources available on the Earth (The Emissions Gap Report, 2016).

All energy sources are divided into renewable and non-renewable. Renewable energy sources are characterized by natural replenishment in relatively short periods of time. Due to this, they are constant. Non-renewable energy sources are characterized by the inability to recover them after utilization.

The use of local alternative energy sources is viewed by the global community as one of the most promising ways to address the growing energy supply problems.

For instance, local resources of biomass are one of the most powerful and affordable alternative energy source on Earth. For many centuries, at least in Ukraine, it has been a major source of energy; and today biomass is ranked as the fourth fuel source in the world. It provides up to 15% of global energy production and belongs to the most dynamic energy sector in the EU, the US and Canada.

There are two types of biomass: vegetable matter that is formed on the basis of photosynthesis and includes different types of plants, and animal organic matter, which contains wastes of life activities and animals processing. According to the

international classification, plant biomass also includes peat (Dr. Sven Teske, Steve Sawyer, 2015).

RES can provide many direct and indirect economic and environmental benefits. In recent years, interest in RES has increased significantly as fossil fuels have highly risen in cost. Interest in RES is particularly high in agriculture, since many RES are a product of agriculture and can provide energy solutions in remote rural areas (Status of Ratification, 2018).

To sum up, it is important to note that currently, the most of RES are more expensive than alternative fossil fuel-based energy sources. However, there were signs that this balance could change. Fossil fuels are limited. Moreover, over time, their limitations will increase, and the cost of production will increase too.

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SMART TECHNOLOGIES IN SCIENCE AND ART

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The emergence of the World Wide Web has greatly influenced the arts. That's how Digital art came into play, which reproduces digital artwork using digital technology. One of the phenomena of such art was the emergence of virtual museums in the 1990s (Vasilina, 2016, p. 98).

A virtual museum is an interactive space that represents information about a museum that exists in reality or on the internet. It allows the user to "navigate" three-dimensional halls and get acquainted with the exhibits.

Museums on their sites have started to introduce this virtual form to promote art to the general public. It is economically viable and easily accessible. That is, anyone with access to the Internet can visit the museum anywhere in the world. Such access significantly saves time, prevents you from leaving your place of residence if it is not possible. And in this way, you can decide whether to visit a particular museum. The exhibits presented on such sites can be used in the initial education process and to enhance the cultural level of all who wish to join history and art.

For those museums that exist only on the Internet, this technology allows to keep exhibits safe and at the same time give users the necessary information in different formats: video, audio, images and more.

Also, a test sample based on a virtual machine of the “Museum of the Bruttians and the Sea” of Cetraro (Italy) was conducted. It was found that this technique can be used as educational material and at the same time entertaining (Barbieri, 2017, p. 101).

But with it, virtual museums have their disadvantages. These include unnecessary information on sites (such as advertising), lack of live communication, software crashes, and low connection speeds. Also, constant Internet browsing decreases your ability to work, worsens your health and Internet addiction. But since

a certain percentage of the population spends most of their time in the World Wide Web, this way they can learn more about the arts and enrich their knowledge in the field.

Information technology makes our lives more interesting, convenient and productive. And we must control our actions not to suffer negative consequences.

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ALTAEROS BUOYANT AIRBORNE TURBINE

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Common wind turbines, which are settled up upon the ground or offshore ones are the most recognizable devices in collection of wind energy. But the antenna wind turbines have many limitations, for instance, the wind near the ground is unstable, slow or gusty, it affects the output power of turbines. And while the ground turbines remain actual for producing pure electricity, the of way generation of low-cost wind energy may be found in high altitude wind turbines (HAWTs) which are situated high upon the ground where they make use of apply more strong and persistent winds.

Altaeros Energies is a company, created on the basis of Massachusetts Technical University, after eighteen months of preparations presented a project at the cost of 1.3 million dollars called Altaeros Buoyant Airborne Turbine (BAT) that will work at the altitude of more than 300 meters that 80 meters higher that the highest ground turbine Vestas V164-8.0-MW. Now it is situated in Fairbanks, Alaska.

The capacity of Altaeros turbine is 30kW (twice comparing to the common turbine of the same size) which is enough for 12 houses, but it is only beginning.

Besides, it can lift communication equipment such as cell transmitter, meteorological devices or other sensors. The company assures that additional equipment doesn't influence the turbine efficient. Such turbine can be useful for distant communities, disaster cases, mining and agricultural companies, rescue organizations.

To lift the turbine on high altitude BAT uses non-flammable helium filled shall. High strength ropes provide the turbine steadiness and conduct produced energy.

Lifting gear suited for the very application and similar to the ones used for aerostats carrying heavy communication equipment for dozens of years. It is hurricane wind resistant and is provided with mechanisms for smooth landing in most emergency cases.

In 2013 Altaeros successfully tested the BAT prototype at the speed of 72 km/h on the altitude of 150 meters on its Maine testing ground. The turbine is similar to aerostats so technically can be put into operation during the 24 hours because it doesn't need any cranes or foundation pouring.

The ground power station controls winch carrying turbine and transforms energy before sending to network.

In conclusion, such a kind of turbines has undoubted advantages. It seems like it is a new turn of wind energy development that will help bringing electricity in the most distant part of our planet.

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ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Water is the most important fluid. It is the basis of life on earth. Unfortunately, people are increasing the pollution of rivers, lakes, seas and oceans every year. Every year, an average of 8 million tons (4-Meter) of plastic waste enter the ocean from land-based inputs (Leabreton, L.C.M. et al., 2017, p. 197). As in all countries, in Ukraine there is a place where water is polluted. In general, most of Ukraine's water bodies are polluted not by plastic waste, but by liquid organic and inorganic waste. Often on the surfaces of Ukrainian rivers and ponds you can see a lot of small algae floating on the surface of the water. Usually, the appearance of such algae on the surface of the water is associated with an excess of phosphorus compounds. Much of the phosphorus compounds come from the wastewater. In wastewater, phosphates come from agricultural and chemical enterprises. Since phosphates are one of the major fertilizers, a significant amount of these compounds will be released from the soil into the water. Phosphates also fall into the wastewater from the use of detergents containing phosphorus compounds in their composition. The negative effects on reservoirs are largely due not to the excessive concentration of phosphates, but rather to the overgrowth of the algae formed as a result, and they completely take away all the oxygen from the water.

Therefore, due to the significant lack of dissolved oxygen in the water, all the local fauna begins to die. In addition to phosphates, the content of fluorides also has a significant impact on the ecological status of the reservoirs of Ukraine. To a large extent, fluoride compounds can enter the water from the chemical industry and from the natural minerals contained in the crust of the earth. Fluoride compounds are of great importance for human health. Excess fluoride in the body is especially dangerous as it can lead to tooth problems. The Institute of Medicine, Food and Nutrition Board has estimated that the tolerable upper limit for human daily intake of

fluoride is 10 mg per day for adults and children over 8 years of age (Pollick, 2004 p. 344).

But despite the fact that the high content of fluorine in the human body leads to problems with the teeth, its low content in toothpastes gives the effect of protecting the teeth from caries. In addition to the two factors listed above that affect hydro-environmental performance in Ukraine, there are other. To maintain normal ecology in the reservoirs of Ukraine, which is related to hydrochemical factors, there are a large number of water treatment plants in Ukraine. They help purify water from debris, heavy metals and other anthropogenic factors. When it comes to the ecological status of Ukrainian reservoirs, we must not forget about the radiation threat to reservoirs. After the Chernobyl disaster in 1986, part of the reservoirs of Ukraine became contaminated with radionuclides, which caused an increase in the radiation background of these reservoirs. It is estimated that during the Chernobyl accident approximately 140 PBq of radiocaesium (134Cs and 137Cs) and 10 PBq of 90Sr and 0.1 PBq of plutonium isotopes were released (Brungot et al., 1999, p.6).

Since 1986, much of the extinct biomass has fallen to the bottom of these reservoirs, but it cannot be definitively said that radiation contamination in such places has disappeared. A clear example of such reservoirs is the river Pripyat. Of course, the environmental status of water in Ukraine depends primarily on people. Various man-made disasters, constant chemical waste emissions will not improve the quality of water in Ukraine. Therefore, the use of environmentally friendly materials, and the cessation of contamination with chemical waste water, it is the key to the normal ecological status of the reservoirs of Ukraine and around the world.

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ELECTRIC PLANES

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Since the 20th century, humanity has begun to take over the air. It all started with simple gliders powered by star piston engines, but technology has been steadily developing, engines increasing their power, and fuel consumption increasing with the rise in power. Therefore, it was decided to increase the efficiency and environmental friendliness of the power plants of modern aircraft.

So, at an air show in Le Bourget, an Israeli startup Eviation Aircraft, which works under contract with NASA, showed a fully electric passenger plane Alice. It is planned to be certified in 2020. The novelty has already passed several tests in conjunction with NASA. The aircraft is reportedly equipped with 980kW batteries, which is ten times larger than the most modern Tesla. However, it can not boast of altitude – its "ceiling" is only 3 km, but the promised range is of up to 965 km at a speed of 450 km/h. It is claimed that the company uses unique technology to allow Alice to fly this distance. The basis is a recycled aluminum battery from Phinergy and a special software algorithm for correcting flight depending on the charge. Apparently, the airplane will be able to charge the batteries directly in the air, using thermal air rises and turning off the motors, which will then go into electricity generation mode due to the oncoming flow of currents. As stated by Eviation head Omer Bar-Johai, the company intends to become Über-like for long distances.

Also, on January 2, Slovenian light aircraft manufacturer Pipistrel tested its first fully electric Alpha Electro aircraft. The press service of the company reports this. The test flight took place in Perth. In Australia, a Slovenian company cooperates with startup Electro.Aero. The aircraft is scheduled to be used for flights to Rottnest Island, located 18 km off the continental coast of Western Australia. The twin-engine aircraft is capable of being in the air for an hour and reaching a cruising speed of 157 km/h.

The Canadian airline Harbor Air is converting its entire fleet of more than 40 seaplanes to electric traction. Today, it is North America's largest seaplane airline – with 500,000 passengers carrying Harbor Air every year, operating daily flights between Seattle, Vancouver and other cities along British Columbia and Vancouver. There are about 30,000 commercial flights a year.

To transition to electric aircraft, the company will work closely with MagniX, which has developed a 750-hp electric motor. Combined with a battery pack, this engine will provide the aircraft with sufficient electricity and power for approximately one hour per flight. Usually, all Harbor Air routes do not exceed 30 minutes, so electrical technology is ideal for them.

"This is the evolution of transport in the direction of electric traction. The internal combustion engine is virtually outdated for Further Development", said Harbor Air founder and CEO Greg McDougall.

The cost of switching to electric traction is the same as installing a turbine engine, but the latter is significantly more expensive to maintain. The first converted aircraft will be the DHC-2 de Havilland Beaver, a six-passenger commercial aircraft used on the Harbor Air route network. The airline, in conjunction with MagniX, plans to conduct its first full-electric flight test at the end of 2019.

At present, aviation accounts for 12% of all carbon emissions in the US and 4.9% in the world. By modifying its existing fleet, Harbor Air will create the world's first fully-electric commercial seaplane fleet. The airline will not rely on fossil fuels and emissions – a significant step forward in the innovation and development of the aviation industry.

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ROBOTICS INTEGRATION IN OUR LIVES

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Enhancement of modern life, attempts to make it easier, safer and more comfortable, all these aspects have been dominating in the minds of scientists for over 100 years. And nowadays, in the 21st century, we can state that it is possible thanks to robots. Fridges, washing machines, computers, smartphones and a lot of other devices surrounding us are great examples of robotics technology.

Generally, creation of the first robots was a breakthrough in science and, especially, in technology, which marked the beginning of a new era on a world scale. Now, they are swiftly penetrating into all spheres of our lives.

Talking about specific branches where robots are used, we cannot but mention mechanical engineering and car assembly, in particular. Of course, 'clever machines' can only realize tasks they are designed for by people.

A vivid example of robotics implementation is artificial intelligence (AI), which can solve problems in different fields of science. This year 'DeepMind Company' has created AI for testing itself in solving different mathematics tasks by using diverse information and methods. However, on the10th of April 2019 they carried out a research, the essence of which was to test this AI in solving school tasks of advanced level and artificial intelligence failed the test, which means that AI is not perfect yet in selection appropriate methods (Hizhnyak, 2019).

Another branch, where modern robotics technologies are widely used, is space engineering. For example, NASA implements robots in production, construction or installation of necessary parts on spaceships, satellites, rockets and other space devices. Moreover, many cosmic drones have already been invented and are used extensively to explore other planets, stars and all space in general. Currently, on the basis of Jet Propulsion Laboratory in California, NASA is testing a prototype of robot consisting of several drones that can function both together and separately. The

apparatus called ‘Shapeshifter’ is expected to participate in a mission to study Titan, the satellite of Saturn. On Titan, ‘Shapeshifter’ will explore caves (The Jet Propulsion Laboratory California Institute of Technology, 2019).

In spite of wide application in scientific and industrial fields, robotics, which principle is based on artificial intelligence, can be successfully used in our everyday life. Pilotless car is a perfect idea of safe and fast means of travelling. Nevertheless, completely ‘independent’ car which can foresee and cope with any possible problem has not been created yet. Therefore, programmers of AI for unmanned car are working on creation of an alternative intelligence which will learn by its own mistakes. One of machine learning-based AI system designed to drive autonomous cars has been presented by Startup Wayve (UK) recently. Each time the driver interferes in driving, the vehicle learns. The intelligent system has already been tested on Renault Twizy and Jaguar I-PACE cars (Robohunter, 2018).

To sum up, robotics technologies are rapidly developing and integrating into our life and will serve for the benefit of humanity.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Computer technology has penetrated the life of society in all its planes, helping humanity to develop, but at the same time, carrying a number of threats. A prime example of this is the development of a new form of mind. This is artificial intelligence. Artificial Intelligence is the ability of automatic systems to formalize and identify properties associated with human behavior. The development of artificial intelligence is related to such sciences as psychology, neurophysiology, mathematics and information technology.

Artificial Intelligence is a very young field of research, started in 1943 by American neurophysiologists Warren McCulloch and Walter Pitts. They developed the first 'neutron' model based on the theory of human brain activity. In 1950, the English mathematician Alan Turing formed the first definition of artificial intelligence.

AI remains one of the most promising and undisclosed areas for the development of information management systems and technologies to date. The concepts of artificial intelligence today include neural networks, fuzzy logic, expert systems, EOM of the fifth generation, systems of modeling thinking. A striking example of AI is a number of companies, including Google, Mercedes-Benz, Honda. They are developing self-driving cars equipped with unmanned aerial vehicles, GPS navigators, high-power cameras, and sensors that allow you to switch offline, recognize road marking, find your location, get directions, find free space and park. Developers assure the self-driving car will go into production in 2030.

Modern "intellectual machines" are capable of imitating individual intellectual functions of a person and, even, individual mental processes, but they are not capable of self-learning, cannot understand human language, engage in meaningful dialogue with a person, are not able to solve problems creatively.

The main prospects for the development of AI are:

- transformation of software engineering into intellectual engineering;
- creation of software systems for imitation of human intellectual activity;
- expansion of "natural intelligence";
- creation of cybernetic models of the human mind and artificial consciousness.

However, the development of AI carries some threats to humanity. Bill Gates said openly, "The development of wholly artificial intelligence can mean the end of the human race." The main threats from the development of AI to humans are:

- partial or complete replacement of a person in technological processes (mass unemployment);
- creation of social, religious and ethical problems (conflict between natural and artificial forms of thinking life);
- the destruction of the Institute of Publicity;
- AI ability to self-replicate and loss of control by the person.

World experts have no unanimous answer to the question, what will happen to the world when the power of artificial intelligence dominates. Will it bring immortality or threaten humanity? One thing we can say is that the era of artificial intelligence has already begun.

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WAVE POWER PLANTS

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At present, there are practical applications of the installations for the use of wave energy in seas and oceans, the total capacity of which according to various

methods is estimated at more than 100 billion kW.

At an average wave height of 2.5 m in oceans and a period of 8 s, the specific energy flow per 1 m of the wave front is 75 kW / m. Specific energy flow of wind waves, for example, in the CIS seas (kW / m): Azov - 3, Black - 6–8, Caspian - 7–11, Okhotsk - 12–20, Bering - 15–44, Barents - 22– 29, Japan - 21-31, and the total power of the waves coming to the coast (within the CIS) is (million kW): on the Black Sea - 14.7, the Caspian - 67.5, the Barents - 56, Okhotsk - 129 .

The positive factors of wave energy include a considerable total potential, an increase in power in the autumn and winter, when electricity consumption increases; and among the disadvantages is its interruption.

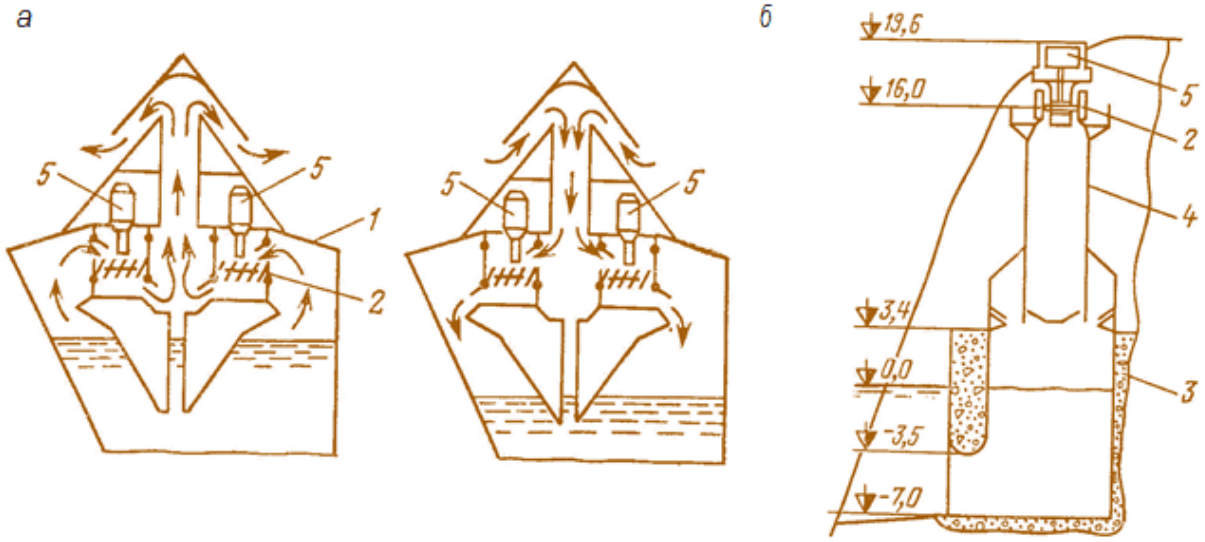

Fig. 1. Diagram of a pneumatic wave power plant: a - scheme of movement of air flow; b - scheme of a wave power plant; 1 - the case; 2 - air turbine; 3 - air chamber; 4 - steel tower; 5 – generator.

There are many navigational buoys that use wave energy in different countries. In 1985, Norway's two first-ever pilot industrial wave power plants were put into operation and connected to the grid.

Wave hydropower installations consist of three main parts – a working fluid (or water intake), a power converter with an energy generator and a mounting system.

The working body (solid, liquid or gaseous), in direct contact with water, moves under the action of waves or changes in one way or another the conditions of their

propagation. Floats, water chambers, elastic tubes, wave-reflecting structures and the like can be used as a working body.

The power converter is designed to convert the energy stored by the working fluid (mechanical energy of solid body movement, water levels in pools, air or liquid pressure) into energy that can be transmitted over a distance or for direct use. Hydraulic or air turbines, water wheels, cogwheels or gears and other devices may be used as power converters.

Oceanlinx Wave Power Plant (Australia)

One of the world's first wave power plants of about 500 kW in Norway is also a pneumatic wave installation, the main part of which is a lower-open chamber submerged below the lowest water surface.

The second of the world's first 450 kW wave power plants in Norway, which utilizes the effect of wave propagation on a shallow narrowing surface (confusional slope), includes a 147 m fjord narrowing channel with a turbine inlet 3 m above sea level. Offshore installations of this type have advantages over other types of wave installations, excluding the complexity associated with their maintenance and repair.

One of the more successful attempts to efficiently process ocean wave energy is the Oceanlinx Wave Power Plant in the PortCamble Water District (Australia). It was commissioned back in 2005, then dismantled for reconstruction and refurbishment

and only re-launched in early 2009.

The principle of its operation is that the waves passing through it, with the impulses, fill a special chamber with water, squeezing the air that exists in this chamber. The pressurized air passes through the turbine, rotating its blades. Due to the fact that the wave direction and their force are constantly changing, the Oceanlinx station uses a Denniss-Auld turbine with an adjusting blade angle. One Oceanlinx power plant has a peak power of 100 kW to 1.5 MW. The installation at Port Kemble supplies 450 kW of electricity to the city's electricity grid.

The waves of the world can generate 2 terabytes of energy, which is approximately 2 times the amount of all electricity produced. Naturally, the amount of energy produced depends on the strength of the waves, which is known to be unstable over time. But the resource used by the wave power plant is absolutely renewable.

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GLOBAL WARMING

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Is heat bad?

After 30 years, temperatures in Moscow, Kazan, Yekaterinburg and Saint Petersburg, could rise by about 3 degrees, according to a study by Crowther Lab in Switzerland. This means that the climate of the Russian capital will be comparable with the climate of American Detroit, and the climate of St. Petersburg with the climate of Bulgarian Sofia. It sounds tempting the Russians are tired of winter, and the cool summer too. However, this is actually a disaster. From 1880 to 2012, the average temperature on Earth increased by 0.85 degrees Celsius. The temperature of

the oceans has become higher, eternal snow and ice are melting. Industrial emissions, in addition to heating the atmosphere, harm human health. Extreme environmental events are increasingly happening droughts, floods, hurricanes and fires. They lead to the destruction of infrastructure, hunger, lack of clean water. The habitat of wild animals is changing as a result of melting ice in the Himalayas, the population of snow leopards has decreased, because of the increase in the temperature of the world's oceans, corals die, and then the living organisms that feed on them. A million species of animals and plants are threatened with extinction today. Entire glaciers disappear in August 2019, the Okyokul glacier was officially buried in Iceland. According to WWF, in the next few decades there will be almost no ice cover in the Arctic. The Arctic and Antarctica are very far away.

Does this concern me?

The north and south poles of the Earth are of great importance for the climate of the planet and are particularly vulnerable to global warming. Due to the fact that the temperature is gradually increasing, the ice of the Arctic and Antarctic is melting. Because of this, the sea level rose 19 centimeters from 1901 to 2010. In 2019, 90 percent of the Greenland ice sheet began to melt. If the ice cover of Greenland continues to decrease at the same speed as it is now, over the course of 200 years, the level of the oceans will rise by 48-160 centimeters. This will lead to frequent floods and hurricanes, and the population of coastal areas and island states will begin to migrate to regions with more stable climates.

What causes global warming?

The main cause of global warming is human activity. People burn fossil fuels (coal, oil, gas), resulting in the emission of gases carbon dioxide, methane, nitric oxide, fluorinated gases. They lead to the greenhouse effect, because they are able to absorb a lot of solar heat. Carbon dioxide accounts for 64 percent of the anthropogenic causes of global warming. Now its concentration in the atmosphere is 40 percent higher than in the pre-industrial era. Forests regulate the climate by absorbing carbon dioxide, but this effect is minimized due to deforestation. From 1980 to 2000, 100 million hectares of rainforest were destroyed for the

construction of cities, grazing cattle, plantations and fields. More than half of the growth in world agricultural production was achieved through deforestation. Agriculture is one of the main causes of methane and nitric oxide emissions: cows and sheep emit methane during digestion, and an increase in the concentration of nitric oxide in the atmosphere is due to the use of many fertilizers.

Why is everyone sharply preoccupied with the problem of global warming?

Global warming has been talked about in the scientific community for a very, very long time. On the other hand, only in 2015, representatives of 195 countries signed the Paris Agreement, according to which it is necessary to keep global warming at 1.5 degrees Celsius compared with the pre-industrial era. This is the only way to prevent a climate catastrophe. However, at the end of 2018, the IPCC published a report in which it stated that the solution to the problems of climate change should not be postponed until later. The main conclusion is that irreparable damage to the planet can be done by 2030. The parties to the Paris Agreement promised to prevent the atmosphere from warming by more than 2 degrees Celsius by 2100, but now humanity is moving to a mark of 3 degrees Celsius. According to experts, humanity have reached a critical point in their influence on the planet, therefore, immediate global changes are needed in all areas of society.

Can global warming be stopped?

Global warming can be stopped, but it will be very expensive and will require political will. It is not enough just to reduce emissions, they need to be stopped. For this, it will be necessary to completely abandon the burning of fossil fuels, to revise the principles of land use, agriculture and urban planning. It will be necessary to find a way to extract excess greenhouse gases from the atmosphere. This means the global economy must be transferred to fundamentally new working mechanisms. So far, heads of state are not ready to take such measures, because, firstly, the need for transformations will have to convince citizens and voters, and secondly, to reform the energy system, it will take 2.4 trillion annually for 20 years!

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VIRTUAL REALITY

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I want to begin with the thought that people before our generation never lived as we live today. New technologies are developing every second. One of the modern technologies is VR.

Virtual reality is a very popular technology in our time that imitates an environment, real or imagined. It is a simulator of a person's physical presence and everything that surrounds a person. This technology allows interacting with it.

We can say that VR makes your brain believe your eyes and create a virtual experience.

Although VR is believed to be only used in gaming, movie, video and other amusements, there has been an emerging applying of technology in such spheres as Military, Education, Healthcare, Space and Shopping.

For instance, students, who are studying for pilots, can take some lifelike experience of flying, shooting and crashing aircraft without doing it in real life.

VR room is a space equipped with stereo displays that track the position of the

eyes and hands of the operator. Visual images of virtual subjects and objects are displayed on special screens. The perspective of what is happening depends on the position of the eye of the person. To ensure the effect of immersion, stereoscopic vision and the visual mechanism of perception of the volumetric image of the parallax movement are used as well as a gyroscope, accelerometer, magnetometer, optical and ultrasonic sensors.

Devices for VR consist of two small screens located opposite each eye, a blinker that prevents the ingress of external light, and stereo headphones. Screens show stereoscopic images slightly offset from each other, providing a realistic 3D experience. Helmets also contain built-in accelerometers and position sensors. For the most part, advanced VR helmets are rather cumbersome, but recently there has been a tendency to create simplified lightweight options including cardboard, which are usually designed for smartphones with VR applications.

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WIND POWER PLANTS

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The use of alternative energy sources is becoming increasingly popular, especially in light of energy-saving technologies. Solar cells, combined with the use of wind power plants, can serve as both an additional and a primary source of energy, thus relieving the consumer from acute dependence on centralized energy networks.

Consumption of other fuels and energy is reduced.

Wind Power Plants (WPPs) are complexes of modern equipment consisting of a wind generator with a power from 100 watts to 10 mW, a charge controller, a set of rechargeable batteries and a voltage inverter. Wind farms are designed to convert clean natural wind energy into electricity that is widely used in everyday life.

Wind turbines are with horizontal or vertical axis. The modern horizontal axis wind generator is more common, has a higher efficiency (almost 3 times), is easy to adjust and implement storm protection, and has a lower cost. At the same time, a low-power wind generator of up to 1 kW with a vertical axis has the advantage of operating from weak winds in all directions, is easy to design and has almost no noise. Such a wind generator has found some use, despite its much higher cost. But mainly horizontal axis wind turbines that produce 95% of wind power are used.

Wind turbines are most advantageous to use in places where it is impossible to make a common grid or connection is very expensive, and also in places with frequent power outages. It is also necessary to take into account the average annual wind speed and to set where this figure exceeds 3 m / s.

The principle of operation of the wind generator is as follows: wind gusts that pass through the blades and rotor of the wind station cause them to rotate. Thus, rotation of the rotor and blades causes the main shaft to move, which in turn activates the gearbox, the rotation of which leads to the operation of the electric generator. As a result, the kinetic wind energy is first converted into mechanical energy on the rotor, and only then, thanks to an electric generator, into electrical energy.

As is known, each medal has two sides. Further on are presented the advantages and disadvantages of this type of alternative energy source, such as wind farms.

Benefits:

1. Eco-friendly kind of energy. The production of electricity by windmills is not accompanied by carbon dioxide emissions or any other gas.
2. Ergonomics. Wind farms take up little space and easily fit into any landscape, and are perfectly combined with other types of economic use of the area.

3. Renewable energy. Wind energy, unlike fossil fuels, is inexhaustible.

4. The best solution for hard-to-reach places. For remote locations, installing wind turbines may be the best and cheapest solution.

Disadvantages:

1. Instability. The absence of guarantees to obtain the required amount of electricity. In some parts of the land, wind power may not be sufficient to generate the required amount of electricity.

2. Relatively low power output. Wind generators are significantly inferior to the power generation of diesel generators, which necessitates the installation of several turbines. In addition, wind turbines are inefficient during peak periods.

3. High cost. The cost of a 1 MW installation is $ 1 million.

4. Danger to the wildlife. The rotating elements of the turbine are a potential hazard for some species of living organisms. According to statistics, the blades of each installed turbine cause the death of at least four birds per year.

5. Noise pollution. Noise from windmills can be of concern to both wildlife and people living nearby.

Today, energy conservation is one of the key positions in the development and economy of consumer services markets.

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THE PERSPECTIVES OF SPACE INTERNET

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Nowadays the Internet is in all spheres of human life. With the help of it we

study, solve productive issues, spend our free time. The number of people using the Internet exceeds 4 billion (Kemp, 2019). Unfortunately, 42% of humanity is still offline due to the fact that the internet is generally unavailable, slow or too expensive for them.

Cheap and high-speed access to the Internet from anywhere on the Earth is no longer an unachievable dream. In the modern world, several innovative projects are been implemented, which can be considered as real technological breakthroughs. The purpose of these projects is global satellite internet, also known as "space internet". A common feature of all the projects is that they involve a network of hundreds or thousands of satellites located at different heights. Low placement will significantly reduce the delay in signal transmission. It will make such services as video calls, online games etc. more accessible to everyone. Future providers of global satellite internet promise ten times faster data rates than they are now.

Google, Samsung and Facebook have said many times about ambition to cover the entire planet with the Internet. Amazon has announced Project Kuiper, a global Internet system of 3,236 satellites. However, OneWeb and SpaceX are the closest to the realization of space internet.

OneWeb is one of many companies seeking to provide the Internet from the space. The company has a plan to launch 650 spacecraft at a relatively low height (Grush, 2019). Their proximity to the Earth can help to avoid delays, that occur in satellites in higher orbits. OneWeb has already launched the first six satellites claiming that the first trials were successful.

Starlink, produced by SpaceX’s is still one of the most significant space internet projects. Elon Musk launched the first spacecraft with 60 satellites as one of the ‘constellation’ parts made up of 12,000 satellites. He plans that by mid-2020, all the Americans and Canadians will already be targeting Starlink broadband. The fact that his plans are quite realistic is been confirmed by his recent Twitter message. "Sending this tweet through space via Starlink satellite," he wrote on October 22, 2019. "Whoa, it worked!!" After full implementation of the project, every point situated on the Earth will see a SpaceX satellite (Brodkin, 2019). Contrary to popular

belief, access to such Internet is unlikely to be free, as Elon Musk plans to spend earned money on developing a BFR for flights to Mars.

Space internet, like other innovative projects, has not only supporters, but still there are some problems with the safety of spacecraft in orbit. The issue of cleaning space from disable satellites also remains open.

I hope these and other issues will be resolved, and many social, economic and educational benefits associated with the implementation of the space internet project will become explored for many people around the world!

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BASIC OUTLINE OF ARTIFICIAL INTELLIGENCE HISTORY, BENEFITS AND SPHERES OF USE

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What Is Artificial Intelligence?

Artificial intelligence is the ability of machines and programs to analyze obtained information, make conclusions and decisions based on data. A key characteristic of

AI devices is the ability to constantly learn, accumulate knowledge and successfully apply them on practice. It is the ability to perform the actions as a human brain does. In the 1960 the first AI algorithms were created. Many of us are have already experienced the work of AI on the Internet, but not everybody is aware of how is exactly works. Using of machine learning and artificial intelligence is possible not only online. The concepts of "The Internet of Things" and "The Smart Home" have long been used along with sophisticated electronic devices which are capable of self-learning and reproducing some algorithms including actions (Artificial intelligence: what is this, 2018).

What are the main benefits of artificial intelligence?

Among the advantages of artificial intelligence one may notice:

- accuracy in data processing;
- ability to analyze large amounts of information at high speed;
- AI does not need sleep and lunch break, it does not make mistakes because of overwork;
- artificial intelligence can be used where people can be exposed to dangerous phenomena (in the presence of explosive materials, open fire, accidents and etc.).

With the help of AI use we can save:

- time, due to fast learning and study without mistakes;
- human resources, work of employees can be directed to solving creative tasks that do not require routine actions;
- money, as AI allows to reduce budgets (How does artificial intelligence work, 2018)

Where can we use artificial intelligence?

As it was already mentioned, the application of artificial intelligence has become possible not only on the Internet. Nowadays everything from everyday routine tasks to complicated manufacturing processes cannot do without electronics devices which have the ability to learn and memorize complex program (Artificial Intelligence, 2019).

Let's consider five major areas where AI is being actively used today:

1. Agriculture. Back in 2016, Cognitive Technologies launched an unmanned tractor, which has a smart navigation system owing to the use of satellite sensors. This technique is very helpful in harvesting and working with herbicides which harmfulness made it difficult to use human labor.

2. Security sphere. Police and firefighters in dozens of countries have been already using AI in their day-to-day tasks. For example, in London, cameras record criminal acts and submit supporting documentation to the prosecutor's office.

3. Home and life. “Smart homes” have learned how to regulate the temperature in rooms, start the work of machinery in time and so on. Today, AI offers hundreds of user-friendly and comfortable features in houses.

4. Education. In this branch, artificial intelligence facilitates routine operations, for example, helps with checking and testing tasks. Digital algorithms are also working to improve data transmission techniques and technologies.

5. Marketing. Thanks to neural networks and other powerful AI tools, marketers collect and analyze data on thousands of consumers much faster, and marketing gets more powerful tools for increasing sales of services and products.

Therefore, we may sum up that the existence of modern technologies cannot do without the application of artificial intelligence. So in everyday life, artificial intelligence is necessary to solve problems of various complexity.

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SENSITIVE SKIN FOR ROBOTS AND PROSTHETICS

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Skin is one of the most important of human organs. We use our senses every day for different things, from ordinary moves to art, from cooking to building new skyscrapers. And when a person loses his skin or part of it, he feels defective. Modern prosthetics cannot solve the problem of losing sensitivity. It causes some problems for sufferers, and complicates rehabilitation.

Luckily, Dr. Ravinder Dahiya and his team from Glasgow University seem to know the solution. At the beginning of 2018 they created new "electronic" skin that uses a variety of sensors to measure things like pressure and temperature. For creating this extremely sensitive skin researchers use grapheme. Despite the fact that it is a film single atom thick, this material is stronger than steel, electrically conductive, and transparent. Artificial skin also has a solar panel to produce energy and making device self-powered (Robots could soon have more sensitive skin than you do, 2017).

A year later researchers from National University of Singapore announced their breakthrough. The research team achieved an incredible response speed using Asynchronous Coded Electronic Skin (ACES). This allowed them to surpass ordinary skin in speed by more than 1000 times (National University of Singapore, 2019).

But the greatest achievement was made by scientists from Technical University of Munich. They developed the first prototype of robot with artificial skin and called it H-1. According to Prof. Gordon Cheng, it consists of hexagonal panels with thousands of different sensors. These plates are about the size of 2 euro coin (only 1 inch). The biggest obstacle in developing robot skin has always been computing capacity. Previous systems were quickly overloaded with data from just a few hundred sensors. To overcome this problem Gordon Cheng and his team tracked only changes in indications, and this reduced the processing effort by up to 90 percent. Just as we notice clothes only when we put them on, sensors notice only changes in

pressure, temperature, etc (Technical University of Munich, 2019).

In future this will bring the interaction of the robot and humans to a new level, reduce injuries at work, and maybe even let robots hug people safely. And in the near future this invention will find application in prosthetics and the creation of artificial limbs.

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THE PROBLEM OF SAVING ENERGY RESOURCES

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Over the recent years the resources of the earth are getting depleted faster and faster. For that reason, a lot of countries around the world are ready to set off a wave of energy saving and carbon reduction in order to avoid the waste of resources and pursue living a sustainable life. This trend of energy saving and carbon reduction as well as power monitoring gradually becomes an important issue associated with maximizing energy savings on the individual, corporate or national level (About ICP DAS PMMS, 2019).

It is practical to realise that energy efficiency is a one-time benefit. The thing is that as soon as 50% improvement has been easily reached by going from the worst

old technology to the best new technology, it is difficult to gain any other 50%. Once there is 90-95% efficiency in most industrial and commercial areas, for example in heating, lighting, and electric motors, you can get another 5% only at enormous expense. Of course, it does not that we should not turn to more efficient technologies, even though in terms of overall environmental impact it is usually best to wear out the existing system first. It basically means that using energy with higher efficiency is quite different from the principles of improving the supply of energy. We can arrive at 50% efficiency only once, while can add 50% to the energy supply many times over. It seems that reducing unnecessary use of energy is even more critical than reducing efficiency of use, and that using energy at 95% efficiency for doing what actually does not have to be done is still a 100% waste (Sherman, 2011).

According to the report of the National Research Council Energy, efficiency technologies existing today or likely to be developed in the near future could save great amounts of energy and money. In fact, adopting these technologies on a large scale could lower projected energy use of 17% to 20% by 2020, and get from 25% to 31% by 2030. Achieving full deployment of these efficiency technologies, however, will depend on some pressures involved, such as high energy prices and public policies specifically designed to increase energy efficiency.

As is known, almost 70% of electricity consumption occurs in buildings. Thus, the energy savings resulting from full deployment of cost-effective energy-efficient technologies in buildings alone could eliminate the need to add new electricity generation capacity till 2030. New power generation facilities would be needed only to address imbalances in regional energy supplies, replace obsolete facilities, or to introduce more environmentally friendly sources of electricity. The numerous feasible cost-effective efficiency investments in buildings to bring the energy use reduced by 30% primarily include replacing household appliances, such as air conditioners, refrigerators, furnaces, and hot water heaters with more efficient up-to-date models. Also, there are opportunities to achieve considerable energy savings in the industrial and transportation industries. For instance, the deployment of energy efficiency technologies in manufacturing industry could reduce the energy use of

14% to that of 22 percent as soon as by 2020. Most of these savings would be found in such highly energy-intensive industries as chemical production, petroleum refining, pulp and paper industry, iron and steel manufacturing, etc (National Academy of Sciences, 2009).

Furthermore, in a study published recently in Nature Energy it is said that the present-day use of existing technologies, which can be far from being perfect, could still save 61% of future costs.

Finally, a number of renewable energy technologies, such as solar panels and wind farms, are now growing in use. They will be playing a key part in reaching the climate targets planned by 2050. Moreover, we have so far already benefited from substantial financial backing to promote their deployment (Dunning, 2018).

All in all, we should encourage the use of energy efficient technologies. Smart energy management will help reduce consumption of energy resources in a way so that to improve old energy-consuming and energy-producing technologies and power plants.

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THE CHANGING WORLD OF POWER GENERATION AND CONSUMPTION

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Nowadays it's hard to imagine our world without electricity. It has changed our life dramatically over the last three centuries. It became a part of our live, something we cannot live without. But do we realize in what way this development keeps changing our life and what impact it produces in the sphere of power generation and consumption.

The consumption of energy grows each year, even though we are trying to save it. In 1800 the energy consumption was less than 0.05 TWh, nowadays the world is using 140000TWh.

To produce such great amount of energy we consume lots of natural sources such as oil, coal and atomic power. This forces us to produce great amount of carbon emissions and other greenhouse gases – the fundamental drivers of global climate change. In addition, mining coal and pumping oil and gas is extremely polluting. Besides, some ways of producing energy are dangerous. For example, nuclear energy stations, apart from making nearly 2,000 metric tons of radioactive waste annually which is only stored in underground storages because it cannot be recycled, can make much more damage which will not disappear over the years. The example is the Chernobyl accident the consequences of which we are still witnessing.

However, there seems to be some ways out of this situation. Now the world has a tendency to implement an eco-friendly way of living. Statistics shows that in 2017 renewable energy represented 17.5 % of energy consumed in the EU, on a path to the 2020 target of 20 %. ("Renewable energy statistics" ,August 2019).

In addition, now there are some innovative researches such as project ITER - International Thermonuclear Experimental Reactor. The goal of ITER is to demonstrate the scientific and technical feasibility of using thermonuclear energy for

peaceful purposes. In addition, ITER's type of thermonuclear energy has little in common with the technology of nuclear weapons and does not provide fissile materials necessary for constuction of weapons. Proponents note that large-scale fusion energy will be able to produce reliable electricity on demand and with little or no pollution. (no gaseous CO_2, SO_2, or NO_x by-products are produced). Solar stations, wind power station and hydroelectric power stations cannot be compared to such a great power output of thermonuclear reactor.

Finally, I believe, that one day people will turn from burning fossil fuels and producing energy from nuclear power stations to alternative (green) ways such as wind/solar/hydro power stations, and of course, thermonuclear energy generators, which don't harm our planet.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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The artificial mind is best suited for all kinds of mechanical activities. Safe exploration of space, depths of the ocean or Earth's core is not suitable for humans or conventional machines.

The real-time learning and classification algorithms are being refined, language processing, image recognition, language recognition, and signals are being developed, as well as customizable user interface models. Among the main

applications that are solved with the help of neural networks are financial forecasting, data acquisition, system diagnostics, control over network activity, data encryption.

Particular interest in AI has been shown in recent years by companies engaged in the organization of processes for the development of large software systems (software engineering). AI methods are increasingly being used to analyze source texts and understand their content, requirements management, specification, design, code generation, verification, testing, quality assessment, reusability, parallel system tasks, and more.

It is very important to develop medical systems that advise doctors in emergency situations, robotic manipulators to perform precise actions during surgery. (Artificial Intelligence: History and Origins of Development, 2017).

Traditionally high interest in AI in the environment of game developers and entertainment programs. Among the new areas of their research are modeling of social behavior, communication, human emotions, creativity in the virtual world. An example of the use of AI in medicine is developed by the Japanese Cyberdyne exoskeleton, which can read the impulses of the main, is expertly engineered brain and send them to the artificial limbs that begin to move. The program is developed Intel enables British physicist Stephen Hawking to analyze it thinking of simulating language with an artificial voice. AI is very economy is widely used, so banks are using AI systems in the management of economic systems, in the insurance activities in the game on the exchange and management staff.

The main prospects for the development of AI are:

- transformation of software engineering into intellectual engineering;
- creation of software systems for imitation of human intellectual activity;
- expansion of "natural intelligence";
- creating cybernetic models of the human mind and artificial consciousness.

However, the development of AI has a number of threats to humanity, Bill Gates said openly: “The development of wholly AI can mark the end of the human race.”

The main threats of the development of AI for humans are:

- partial or complete replacement of a person in technological processes (mass unemployment);
- creation of social, religious and ethical problems (conflict between natural and
- artificial forms of thinking life);
- the destruction of the Institute of Publicity;
- AI ability to self-replicate and loss of control by the person. (Artificial Intelligence: Perspectives and Threats, 2015)

Thus, on the one hand, the development of artificial intelligence will be the end of the human era, but on the other hand it is a new level of existence, incredibly fast technological development, immortality and much more that humanity has long dreamed of.

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GEOTHERMAL ENERGY PROSPECTS

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Renewable energy in the world is growing rapidly. The annual volumes of introduction of new RES-based power plants substantially exceed the growth of thermal generation. Also, the amount of annual investments in RES generation is several times higher than investments in gas, coal and nuclear power plants.

At the same time, the main growth is due to wind and solar power plants, and for many, they have become symbols of RES and "green" energy. Geothermal power plants, or GeoES, are also a very interesting area, potential of which is very high.

Some researchers believe that in the future, geothermal energy can provide up to 1/6 of the world's energy supply. Not least because, unlike solar or wind, geothermal energy is completely independent of day and night changes or weather and seasons, it has a number of other advantages, which will be discussed further.

According to the IRENA (Renewable capacity statistics 2019) database, in 2018, the global installed capacity of geothermal power plants increased by 540 Megawatts to 13,329 Megawatts. Going into the depths of the planet, the temperature will rise by about 3 ° C every 100 meters of descent, although in different regions of the Earth, this indicator (the so-called geothermal gradient) may vary. This means that some sites are better suited for building a geothermal power plant, and some are much worse, while it can be economically unprofitable to dig a well to the desired temperature layers; hence, the popularity of GeoEPS in countries with high seismic / volcanic activity. Depending on the available source of geothermal energy, GeoES can be roughly divided into hydrothermal, binary hydrothermal and petrogeothermal. In hydrothermal power plants, hot steam rises from the pipe laid to the aquifers, which rotates the turbine of the generator. If the steam-vapor mixture rises above 150 ° C instead of steam, its water part is separated in a special separator and can further be converted into steam for the generator under low pressure conditions.

Binary hydrothermal power plants are used where the water temperature does not rise above 100 ° C, and it is no longer profitable to dig the well or for some reason impossible. Then this water is used to heat another working fluid with a low boiling point, such as Freon, the steam from which is fed to the turbine generator.

Petrogeothermal stations are a relatively new phenomenon. In places where the Earth's crust temperature is suitable for GeoPP, but the aquifers are almost absent, a well is drilled (at a depth of 3 to 10 km) and two pipes are installed. One of them is pumped with water, which is heated in the pressure generated by the fracturing and is returned through the second pipe in the form of steam for the turbine. As of 2018, there are only 22 geothermal power plants operating in the world, most of which are concentrated in Europe. According to some scientists, petro-geothermal energy is enough to provide humanity with energy forever.

Ukraine has a significant number of geothermal sources with high temperature potential in the range of 120 ° C - 180 ° C. Such temperatures are sufficient for electricity production. According to various estimates, the potential of economically significant thermal water energy resources in Ukraine is 8.4 Mt / year. Geothermal water heating is already operating on the Crimean peninsula, where 11 geothermal water circulation systems are in operation. These systems meet the requirements of modern geothermal heat generation technologies. Both pilot and industrial installations operate. Large reserves of thermal waters are in Chernihiv, Poltava, Kharkiv, Luhansk and Sumy regions. Hundreds of thermal water wells have been conserved, but may be open to exploit the potential of geothermal heat.

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PHYSICALLY BASED RENDERING AS A WAY TO HIGH-QUALITY GRAPHICS IN GAME DEVELOPMENT

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Nowadays the technology seems to be evolving with the tremendous speed and it is not always easy to keep up with it. All aspects of our lives involve interaction with smart devices but the part that is consumed almost to the full extent is entertainment. People constantly play games when they are bored or have spare time. Therefore, game industry has grown significantly over the past decade. Huge companies hanker after customers’ attention overcoming any obstacles on their way.

Games that were considered modern a few years ago are literally nothing in comparison with the ones that are being developed now. However, the plot of most games actually remains the same. Then what has changed? The answer is graphics.

In order to achieve outstanding results in appearance game development studios had to go great lengths. First of all, a prototype of a character or a part of the set has to be created as a 3D model. Next, the hardest and the most important part is applying textures. Indeed, it is a time-consuming process for an artist to draw something that has a lot of chaotic movements or shown in many different light settings. The question is how to make any visual game experience even more real but quicker and more efficient using modern technology?

The best way to approach this problem is to turn to PBR which stands for Physically Based Rendering. First of all, the definition of PBR tells that it is a method in computer graphics that seeks to render graphics in a way that more accurately models the flow of light in the real world. (Russell, J., 2015). Obviously, the key to successful realistic graphics rendering is light and, therefore, shadows.

PBR generally consists of a few aspects but the boundaries between them are a bit blurred because they are all connected in some way. Things to consider in PBR are the position of a camera, light sources, shadows, light reflection, textures and so forth.

The position of a camera in any game determines a lot of things but what really makes it important in rendering is the perception of the light rays. Creating life-like experience involves making the view feel real. For example, when an eye looks at a shiny object it sees the light that is being reflected by it. But when this object or the eye is shifted light rays may point in a completely different direction which immediately changes the view. Secondly, the placement of any light sources in the scene is also crucial. If you look at the games of previous years you might notice that the image looks flat. This happened because no direct light was applied to it. The lack of light has led to the absence of shadows especially from the minor objects in the scene. In addition to appropriate light setting, the properties of different materials should be taken into account as well. Rays are absorbed or reflected depending on the

microsurface of an object whether it is smooth or rough. Finally, the shape of an object plays an important role in realistic rendering because it determines the area of the shadow, the perspective of the view, the shape and flow of the reflected light etc.

In fact, it is nearly impossible for a person to capture all those things all at once and apply them to the vast number of objects in one scene. To make everything synchronized without missing out any detail game engines are created based on a set of physical laws. The computer can analyze the position of light source, camera and the object and apply the necessary filters to make it look like in a real world. It takes more than 200 employees to make a very simple game engine to work. One of the most popular game engines that can perform physical based rendering is Unity which is popular among professionals as well as beginners. Using Unity game engine to create a game and render graphics has brought one of the most popular mobile games into the world Hearthstone. Even though it is a card game it was created in 3D. The arena of cards can be viewed from different sides which creates an opportunity to make the camera fly around at the beginning of the game. In addition, the cards also have their own shape with many interesting elements. Because they are not flat, they appear on the screen with an amazing animation that feels like pulling a card in reality. Of course, the game contains all of the aspects of high-quality graphics like light, shadows and textures that make it seem realistic.

The increasing need in realistic graphics in game development has created an opportunity for a new technology to be implemented in work like Physically based rendering. It allows to build realistic 3D games a lot quicker without any loss in quality because of the set of physical laws that were previously programmed into a game engine with PBR option like Unity.

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ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Ukraine has always been well supplied with water resources. Chains of river valleys, gullies, ravines with numerous waterways, from small streams to large rivers, such as the Dnipro, the Siverskyi Donets, the Dniester, the Southern Bug, the Ingulets, the Tysa, etc. cover the territory of our country. According to statistics, the best supplied regions with drinking water are Volyn, Chernihiv, Sumy, as well as the northern territories of Kyiv and Poltava regions. However, in recent years, the quality of water is constantly deteriorating. Many of these waterways are about to disappear. And the urgent concern is not only that their water becomes non-potable, but also inappropriate for public use in general. It happens because of man-made pollution by discharge of sewage, water flushing of toxic compounds from the surface of agricultural landscapes, excessive recreational loading, clogging. Therefore, if this rate of pollution is not decreased, the country's population will face with lack of drinking water in the near future.

According to official statistics, about 300 million cubic meters of untreated wastewater are discharged into the reservoirs of Ukraine every year. In fact, pollution standards are exceeded in each Ukrainian reservoir. The average annual data of laboratory measurements conducted by the State Agency Authorities of Water Resources of Ukraine have indicated high content of difficult and easy-to-oxidize contaminants in water. Moreover, significant water quality deterioration was registered in the Dniester River last year. Manganese and phenol were found in the Danube. Similarly, 90% of samples from the Dnipro recorded the excess of contaminants and physico-chemical surface water quality indices. According to the research results the most polluted water is in the urban settlement Bilyaivka in Odesa region. On the one hand, high temperature is summer causes mass bloom of water, and, as a consequence, dissolved oxygen decreases to critical values increasing

organic pollution of water. On the other hand, the wastewater treatment is very poor. As a result, heavy metals and pesticides get into the rivers and lakes. In addition, water is polluted by atmospheric precipitation, which washes away industrial and household dirt from the territories of enterprises, mines and city streets. The worst thing is that oil products getting into rivers and lakes form a film on their surface, which prevents gas exchange between the water and the atmosphere and reduces the oxygen content in the water. Another problem is that rivers become shallow and lakes and reservoirs become silt under the influence large and small mineral particles runoff from eroded lands.

Putting on icy roads salt-containing mixtures to make them safer in winter has led to the situation when Ukrainian water reservoirs turn into estuaries because of water saltiness. This phenomenon is explained by the fact that during the snow melting all reagents flow directly into the Dnieper. The road service cannot completely refuse salt. The choice of chemical composition for mixtures depends on specific climatic conditions, density of the car flow and possibilities of the regional budget. The reagents contain substances that cause cancer, sterility, diabetes, immunity problems and provoke endocrine system disorders.

To sum up, environmentalists propose to develop and adopt the new Water Policy that will identify freshwater as a strategic state resource. Experts believe that, first of all, to improve the status of reservoirs, it is necessary to ensure the optimal combination of forest plantations and meadows around water bodies, to carry out a complex of measures to stop the discharge of untreated wastewater, as well as, to monitor the condition of hydro-technical structures on the rivers. Enterprises engaged in production activities should be equipped with rainwater sewer systems with treatment facilities to prevent contamination of city water bodies with untreated rainwater. If we do not start today, we will not survive.

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WHY IS THERE 110 VOLTS IN THE US AND 220 VOLTS IN THE UKRAINE?

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Many people do not know that untill the 60s in the USSR, there were 127 volts. In the USA, there were 120 volts, instead of the usual 110 volts. The voltage on the power grids was increased in order to reduce the cost of materials for wires. The current strength decreases with increasing voltage and maintaining the same power, which allows to reduce the cross-sectional area of the wire. Technically, the voltage of 220 volts is much higher, but a complete transition to 220 is a very expensive solution.

Historically, this is due to several factors.

Thomas Edison launched the mass production of carbon filament incandescent lamps. The optimal voltage for it was 100 volts. At that time there was an expression — «War of the currents». This was explained by the fact that the operating voltage of the first power plant of T. Edison was 110 volts. 10 percent he laid on the losses in the conductors. Another possible reason was that Edison was actively promoting his gearing at 110 volts.

Together with electrification in Europe and the incandescent lamps that appeared thin, with a metal thread, it became necessary to double the voltage. In Germany, 220 volts were used during the electrification of Berlin. This decision was rational. It allowed four times to reduce losses in conductors. But it was not safe to raise the tension, for a person's life.

A typical US power system is the TN-C-S system. The step-down transformer provides a single-phase voltage of 120/240 V from the secondary winding with a grounded middle terminal. There are cases when a step-down transformer feeds residential buildings and enterprises at the same time. The power supply of residential buildings is carried out from two phase conductors and from a neutral working conductor connected to a grounded neutral wire of the secondary winding of the transformer, connected to a "star" and with a voltage of 120 / 208V with a frequency of 60Hz.

Russia and Europe adopted the standard of 220 volts. This is explained by the following. The fact is that the construction of the energy system in Russia, and later in the CIS countries, was carried out by scientists from Germany. And they did everything just as they did in Germany. And in the future, we began to simply adhere to these standards of 220 V and 50 Hz.

The result of this was that the main's voltage throughout the post-Soviet space is 220 volts at a frequency of 50 Hz. Many European countries have a network voltage of 230 V at a frequency of 50 Hz. This voltage in the network not only reduces losses in the transmission of electricity, but also allows the use of electrical appliances with greater power.

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DISTRIBUTION OF CONSUMPED POWER OF ELECTRIC CARS

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Currently, electric cars are gaining more and more popularity in the world. Humanity gives priority to the creation of more environmentally friendly transport. In this aspect, electric cars have an advantage over cars operating on oil products. By technical characteristics, modern electric cars are also not inferior to their competitors.

In 2018, around 1.3 million all-electric cars were sold all over the world (excluding hybrids), and 60% of this amount was in the Chinese market. By 2025, their sales will increase to 25 million, which is estimated to be 20-22% of all cars. Gradually, growth will become more moderate but stable, as experts predict. Such data in March 2019 led analysts at Bloomberg New Energy Finance to believe that the rapid growth of the electric car market will inevitably lead to the need for a large number of new chargers for owners of such cars. Chargers installed in the homes of electric vehicle users will undoubtedly create an additional load on the electric network. Various charging methods (CM) for private cars are considered to simulate different power distribution patterns during the day.

Charging method 1 (CM 1) - The vehicles are fully charged to maximal power at the arriving moment, using the requested power from 18:00 till 21:30. This CM is not favourable for the network because here electric vehicles are charged directly during the peak load of the electric network, which creates additional pressure on it. Contrariwise, CM 1 is profitable for people because it allows you to charge the vehicle quickly, providing enough condition of charge for driving the car later, if necessary.

Charging method 2 (CM 2) - Here charging takes place over the entire available time interval. Consequently, charging occurs mainly at night. Because of this, the charging power of electric cars almost does not affect the electric network at

the moments of its peak load, which makes CM 2 especially useful for the grid. However, in order to realize this, the CM 2 needs to know exactly what time the car arrives and leaves, that is the electric car cannot be operated after arriving home.

Charging method 3 (CM 3) - In accordance to this method, cars are charged at maximal power, but here the charging process begins only when the demand for energy has decreased, and not immediately after arrival. Electric cars load the network no longer during peak moments, so the network load decreases compared to CM 1.

Characteristics of charging methods: The first method involves charging an electric car at maximum power immediately after arrival. Although this solution is beneficial for residents, it harms the power grid, as electric cars charge at peak times, which increases pressure on the grid. In CM 2, most of the charging process takes place at night, which makes it useful for the network, but can create some problems for the owner of an electric vehicle. In CM 3, cars are recharged with maximum power, but, unlike CM 1, the charging process begins after the maximal load has dropped. Therefore, CM 2 and CM 3 are more favourable in terms of grid control.

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SOLAR PANELS

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A solar panel is a prefabricated panel that absorbs solar energy and converts it into electrical or thermal energy.

Advantages of solar cells: light weight, small size, rising house prices, and payment under "green tariffs" to protect the environment.

Disadvantages of solar panels: not suitable for all roof structures, inconvenient in the case of movement, saving a small amount, low consumption, and relatively expensive.

The rapid development of solar energy with innovative world technologies is a major trend. Unlike other sources, solar energy will never be outdated, will not be controlled by foreign countries, and will not end, which will make it able to always keep pace with the times.

The main advantage of solar panels is that after they are installed and connected, their own electricity is generated, dependency on the electricity supplier is reduced and their energy consumption is minimal. The average life cycle of solar panels is 25-30 years. Therefore, by connecting your own solar power plant, you are guaranteed to reduce electricity costs during this period. The estimated savings over these 2-3 decades from solar energy are calculated for each home separately.

Solar panels are divided into three types: thin-film, single-crystal.

Thin-film batteries consist of flexible films that can be easily installed anywhere. They are not afraid of dust and can work even in adverse conditions. In cloudy weather, their effectiveness is reduced by 20%. They are inexpensive, but require a large area to install.

This type of battery is made from a large number of individual sockets that are filled with silicone. Thanks to such waterproofing, they are effectively used in navigation. They can also be installed on roofs. Naturally, the sunny side of the roof

will work more efficiently, but if for some reason it is not possible to install batteries from the south side, they can be moved to a more shaded slope. It should be kept in mind that scattered light is less effective.

Monocrystalline batteries are relatively small, compact in size. They are flexible, light in weight, compact, reliable and durable, easy to install, depending on direct sunlight. In this case, even light clouds can cause a cessation of energy production.

To summarize, it should be borne in mind that investing in solar energy is quite profitable and low-risk. Although it requires considerable financial resources and a return on 4 years. Rooftop solar panels are not suitable for everyone, but for the vast majority of homeowners. Solar energy is a pure passive income, an opportunity to influence the consumption of electricity, the contribution to nature, convenience and energy independence!

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3D PRINTERS AND THEIR POSSIBILITY TO MASS PRODUCE COST-EFFECTIVE EARTHQUAKE-PROOF BUILDINGS/STRUCTURES IN DEVELOPING COUNTRIES

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I.INTRODUCTION

We all know the scourge and dangers of earthquakes. The scale of an earthquake is in direct correlation to the effect it has in environment, community, city or country at large. In an HIC (high-income country) or a highly developed country, many steps have been taken to mitigate the damage done by earthquakes, and this

includes Early Warning System, monitoring/predicting the time and scale of potential earthquakes and finally, using engineered structures/designs specially made to help keep buildings and other constructions intact during earthquakes. In LICs (lower-income countries) or lesser developed ones, like Nepal for example, the resources/investment needed to curtail the dangers of earthquakes is simply not enough, and therefore newer and more cost-effective methods need to be sought after and implemented. The goal of this piece is to bring into light the possibilities of reducing the cost of earthquake-proof engineered structures/designs utilizing the lately popular technology of 3D printing that would better benefit these developing countries.

II. CURRENT METHODS USED IN BUILDING EARTHQUAKE-RESISTANT STRUCTURES IN DEVELOPING COUNTRIES

Firstly, before diving into the concept of using 3D printers for cost-effective earthquake-proof structures, it is necessary to summarize the methods currently being used in LICs to better handle and lessen the effects of earthquakes.

- Waste tire pads: This method is focused on isolation-base pads that use the scraps of automobile tires to isolate seismic waves.
- Bamboo houses: an affordable, renewable source of building material that has higher tensile strength than steel and greater compressive strength than concrete.
- Stone foundations made from rubble of destroyed houses.

III. CONCEPT ON THE POSSIBILITY OF USING 3D PRINTERS TO PRODUCE EARTHQUAKE-RESISTANT STRUCTURES/BUILDINGS

Although 3D printing is a relatively new field, it has already made huge strides in the advancement of other fields like the medical, manufacturing and food sectors. This huge sphere of influence is largely thanks to the seemingly limitless capabilities of 3D printers. The only current limit on the use and application of 3D printing is the user or designer and his/her imagination. Engineers have recognized this and are always attempting to find ways to use these printers to garner solutions to different problems. In the case of earthquake mitigation, a team of researchers have been able

to use 3D printed metamaterials to control vibrations. This works because these metamaterials are artificial composite materials that have electromagnetic properties that block sound waves and vibrations of varying frequencies. Natural materials have a fixed geometry that limits its properties and in essence, the principle of decreasing the size of a geometrical feature in a structure would increase its operational frequencies and will use local resonances to control acoustic waves ranging from seismic excitations (Hertz) to structural vibrations (kilohertz). The ability of the 3D printer to manufacture down to the size of nanometers makes it possible to realize complex structures in many materials including metals, ceramics and polymers that present new types of architected materials for vibration mitigation. Another example is architects that have created a column capable of diffusing the force of an earthquake. Here the use of the interlocking mechanism of the 3D printed bricks allows for an absence of resonant frequencies entirely and when combined with the bricks' individual hollow nature can be optimized for intensive vibrations in zones of active earthquake activity. 3D printers have helped reinforce and strengthen otherwise low-ductile materials that would not normally be able to absorb energy and be used in earthquakes zones. The methods mainly focused on up until now are mainly based on 3D printed vibrational controlled structures and earthquake-resistant materials. These work to function as lightweight structures with limitless forms that can potentially provide even greater resistance for buildings.

IV.COST EFFECTIVENESS

Most of the population in Nepal, for example, live in rural villages where the houses are made out of stone or mud bricks. A glaring advantage here is the cost savings that 3D printers have in reducing costs of labor needed to make those bricks or assemble those houses and reduction of the cost due to higher efficiency as 3D printers are faster and human-error free thereby also inadvertently cutting costs that would have otherwise been used in unnecessary maintenance. The printer assembling the structure or house from scratch means that less waste is produced and on-site assembly means that too much storage space for traditionally built materials is not needed.

V.CONCLUSION

The question still lingers; is it possible to mass produce these 3D printed houses/structures? With the benefits of the cost-efficiency stated above, combined with the ever advancing designs by engineers, the future looks bright for the possibility of mass production. Seeing that the 3D printer prints and designs faster than traditional means it is thereby feasible to look into adopting 3D printers as a technique for mass producing cheaper and durable structures for buildings that would help reduce the catastrophe of earthquakes in developing countries.

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HISTORY OF SOLAR CARS

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From the beginning of the XX century, scientists have been trying to create "ideal" solar car. The first solar car was created in the USA in the middle of last century, but it had lots of problems and disadvantages. For instance, that car consisted of poor and infirm batteries, which had small capacity. In that time, there were no technologies to make the batteries much more powerful (Douglas, 2019, p.2). Therefore, a development of this field was held up.

New stage in solar cars industry started at the end of last century. There were many attempts to improve previous investigations. And everything went much better. Constructors improved galvanic elements, consequently, an amount of generated energy increased. That's why cars had an ability to surmount longer distance. In addition to this, power reserve has been extended via creating flexible batteries. Despite all developments in this field, no one could create a car, which would be affordable for mass production. There were some crucial cons, such as: a high price, a low efficiency of solar batteries, a low speed and others. But the main problem was inconvenience, because all models aren't comfortable for ordinary families. In spite of many difficulties, a lot of big companies were trying to improve all points and making new attempts.

And one of German enterprise coped with it greatly.

In 2016 Sono Motors was created in Munich, Germany. For 2 years it had been designing a concept of full-electric solar car-Sion. The main assignment of this project is to save resources. Community gave finances for this project, because they wanted to realize and trusted the company. The car consists of solar galvanic elements and can be charged from solar energy or from traditional power sources. This car is very similar to our ordinary vehicles. Five persons can travel in it comfortably. This fact is very essential for those, who want to buy such type of car.

As Laurine Hane said, Sion has 330 solar panels (Sensiba, 2019, p.3). The car is covered with them from all sides. Battery system can provide 250km continuous motion. The uniqueness is that, full charged solar car produces electricity when it is needed. Consequently, this approach is much more efficient, because for ordinary electric cars you have to transport energy from power plant or solar panel then put it into electric car. These solar panels are working every day, for the whole year. So you don't need to do anything. It's interesting to know, that you may park the car in sunshine or in a shade, because diffused light is also used to create energy. Moreover, Sion can be used as power source and can charge different devices: from mobile phone to other electric car. In addition to this, German company implements new approach in ventilation. A dashboard inside the car is equipped with a special natural moss. It regulates a temperature and a level of humidity in cabin (Marsh, 2019, p.8). Also, it doesn't require watering and other cares. The maximal speed is 140 km/hour.

This car has been selling since May 2019. It costs approximately 16 thousands euros. The developers expect a big demand on this car. On the other hand, they understand, that there many new things to improve. All in all, solar car is a very modern industry and, surely, will continue to develop.

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SOLAR PANEL

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A solar panel is a type of precast panel for absorbing solar energy and converting it into electrical or thermal energy.

Photovoltaic module (solar panel) is a wrapped and electrically connected collection of photovoltaic cells that are integrated into a photovoltaic system to generate and store electricity. The output power of each module (under the standard conditions of use) ranges from 100 to 365 watts.

Typically, a photovoltaic system includes a panel or groups of panels, a solar converter, and sometimes a battery and a solar tracker. The cost of solar energy, along with the cost of batteries, is rapidly declining, which contributes to the widespread use of such complexes in the industry and by individual consumers. When grid parity is reached, the cost of this electricity will be lower than that of traditional non-renewable sources.

Currently, the market is dominated by three types of solar cells: thin-film, single-crystal and polycrystalline.

Most popular among buyers are single-crystal solar panels. This type of a battery is made up of a lot of silicone cells. They perform the function of converting electrical energy from the sun's rays that hit their surface. The most optimal number of cells in single-crystal batteries is 36. This has a very good effect on electricity generation. Monocrystalline batteries are quite lightweight and compact, even bendable. Thanks to this property, it is not difficult to install the battery data on uneven surfaces, where it will be difficult to achieve the right angle.

Single-crystal batteries have a strong and reliable body. Due to it, moisture does not penetrate inside the installation, and so the installation data can be used on long-distance ships. Solar panels are more reliable and durable due to the lack of

moving elements.

Thin-film solar panels are considered to be the cheapest option of all existing types of batteries. This is quite clearly reflected in the demand for this type of a battery by consumers. This type of a battery can be installed in any place that is most convenient for you: a wall of a building, roof or land. Unlike single-crystal batteries, thin-film solar cells do not require direct sunlight. In terms of power, they are also more comfortable than other types because even in cloudy weather they lose power by only 10 - 15%. The only thing that can be negative about this type of solar panels is the occupied area: almost 2.5 times more than others.

Polycrystalline solar panels are also considered as an alternative to single-crystal batteries. In their structure is used polycrystalline silicon, which has a bright blue colour. Polycrystalline solar panels are widely used to illuminate yards, parks, streets, highways, hospitals, cafes, schools, private homes, communications, as well as to supply gas and oil pipelines, to charge batteries.

Advantages of solar panels:

• small weight and dimensions;

• low cost compared to, for example, fuel cells;

• simplicity of construction;

• long service life.

Disadvantages:

• inability to deliver at night the same power output as in the daytime, requiring the use of a battery that would be charged in the daytime to support the load in the dark;

• a sharp dependence of the output power on the angle of incidence of rays on the photosensitive surface, forcing the use of automatic orientation systems in space;

• the inability to get power from a square meter of solar cells exceeding 0.1 kW using cheap materials;

• rapid degradation of photovoltaic cells in conditions of high radiation background and penetrating radiation.

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HEAT PUMPS

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The development of new products, production and utilization of innovative energy-saving technologies in the social sector that would simultaneously provide sustainable economic growth and improvement or environmental protection is extremely important today.

The analysis of the foreign experience of reforming the social sphere in the field of energy saving made it possible to conclude that it is necessary to form own innovative model of reforming the social sphere, oriented towards the development of innovative projects on energy saving technologies.

The conducted research revealed the main problems of implementation of innovative projects on energy saving technologies in the social sphere in Ukraine:

- the lack of interest of the state in the development of energy saving, and the lack of institutional and financial support in this direction;

- low level of budget financing of energy saving programs;

- for the most part, complete lack of own financial resources for energy conservation purposes;

- absence of any influence on consumers of energy resources in order to increase their interest in energy saving;

- underestimation of the role of the social sphere in energy saving;

- low and often complete lack of consumer interest in implementing innovative energy-saving projects;

- insufficient number of qualified personnel.

In developed countries, energy efficiency programs have been around for a long time and have had a significant impact. Despite the specifics of the measures being implemented in each country, much of the energy-saving experience can be learned and used in our country.

Earth is the largest and most important source of energy. At a certain depth, the soil has a temperature of about ten degrees Celsius. In comparison with the air, the soil temperature is constant. This means that when the topsoil is freezing, geothermal heat pumps can operate efficiently, since the difference between the heat source and the flow temperature remains relatively low even in winter.

The principle of operation of the brine-water heat pump

The brine-water heat pump operates on the same principle as all other heat pumps: heat is first drawn from the soil and then transferred to the refrigerant. There is a process of evaporation and compression of the refrigerant in the compressor. This increases not only its pressure but also its temperature. The resulting heat is absorbed by the heat exchanger (condenser) and sent to the heating system.

Possibilities of using soil heat

Geothermal energy can be obtained in two ways: through collectors that are laid near the surface or through soil probes that penetrate the earth to a depth of 100 meters.

Collectors lying underground

Collectors are horizontal tubes laid in the form of a coil underground, below the freezing line of the soil. Their depth is 1-2 m from the surface of the earth. Frost-resistant fluid circulates in the pipe system, which absorbs thermal energy and transfers it to the heat exchanger. The size of the collector depends on, among other factors, the need for heat in a home. In practice, its area is 1.5-2 times larger than the area of heated premises.

Land collectors absorb thermal energy from the surface area. Earth receives

energy through sunlight and rain water. Therefore, the soil plays an important role in the process of obtaining heat. It is not recommended to place or asphalt any objects on the site under which the collectors are located.

Ground probes are heat from deeper Earth layers

An alternative to collectors is geothermal probes. Through the holes, the geothermal probes are inserted vertically or angled into the ground. The brine flowing in the vertical tubes collects heat at a depth of 40 to 100 m and goes to the heat exchanger. Since the temperature remains constant at a depth of about ten meters throughout the year, the earth probes work effectively even at very low air temperatures. In addition, they require a small area compared to the collectors and can perform the function of cooling in the summer. The depth of the probe depends on the required power and thermal conductivity of the soil. Wells more than 100 m deep are always subject to clearance, as they may have contact with groundwater.

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USING DRONES TODAY

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Unmanned vehicles are now used as toys, flying platforms for photo and video shooting, military intelligence tools and even as sports equipment. The first quadcopter on the radio appeared a little more than 20 years ago, and today such devices are already widely popular. Each drone consists of 5 main parts: engines, revs, propellers, flight controller and frame. The history of drones does not stop at the stage of entertainment and highly specialized use, as the founder Robert Garbett already discusses how drones will become an essential part of smart cities.

According to the sources, smart cities will rely more on wireless aircraft technology. The successful connection of drones to cities is needed to use a cloud-based drone platform. It allows you to simultaneously manage connected devices that are safely deployed and protected from being compromised (Drone major group, 2018, p. 16).

Companies such as Cyber Major and SUAC Global argue that drones are becoming a more common solution in the security sector for scanning traffic in assailable places such as airports, stations and during the period of terror. In the UK, the coast guard already uses scanning technology for some coastlines. In addition, some police forces began to use drones during operations to search for attackers or riots on the go. Since drones can also drop urgent medicines if necessary, look for people who are trapped as a result of natural disasters, etc. The fire service is now learning how to apply drones to deal with fires that are caused by road traffic accidents (Drone major group, 2018, p. 18).

Drones have also found application in agriculture. From the sources it is known that they are used for scanning agricultural crops to ensure the targeted use of processing methods. It was also found that aircraft can detect diseases in agricultural crops faster than a person can notice them (Drone major group, 2018, p. 22).

Despite some shortcomings, drones make life easier for humanity as they perform errands that are dangerous or difficult for humans. Undoubtedly, drones will be soon followed by flying cars as traffic jams are the main problem of big cities. All of that sounds amazing, but many people have doubts or even fears: Will computer replace a human? Will people be useful? But besides all this one should not forget that new technologies are being created to expand our capabilities rather than replace us.

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DEVELOPMENT OF NUCLEAR ENERGY

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The twentieth century was marked by the development of a new kind of energy concentrated in the nuclei of atoms, and became the era of nuclear physics. This energy is many times greater than the fuel energy consumed by mankind.

It turned out that the uranium atom can be split into two parts. Nuclear fission reaction of uranium is effective and far outweighs most chemical reactions. Compare the uranium atom and the explosive molecule – trinitrotoluene (TNT). When the TNT molecule decays, 10 eV of energy is released, and the decay of the uranium nucleus is 200 million eV.

The scientists understood that the main purpose of nuclear energy was to produce electricity and use it for peaceful purposes. With the commissioning of the world's first industrial nuclear power plant with a power of 5 MW in Obninsk, USSR, in 1954, the era of nuclear power began. The source of electricity production was the splitting of uranium nuclei.

The experience of operating the first NPPs has shown the reality and reliability of nuclear energy technology for the industrial production of electricity. Developed industrial countries have started designing and building nuclear power plants with reactors of different types. By 1964, the total capacity of nuclear power plants in the world had grown to 5 million kW.

The rapid development of nuclear energy has begun, which, making an increasingly significant contribution to the world's total electricity production, has become a new promising energy alternative. A boom in orders for the construction of a nuclear power plants in the US, later in Western Europe, Japan and the USSR, has begun. Atomic energy growth reached about 30% per year. Already by 1986, there were 365 units with a total power of 253 million kW. In almost 20 years, the NPP power has increased by 50 times.

The conditions for the development of nuclear energy were quite favourable, in

addition, the economic indicators of the NPP were also optimistic, the NPPs were already able to compete successfully with the TPP. Nuclear power has made it possible to reduce organic fuel consumption and reduce pollutant emissions into the environment from TPPs (Denisevich, 2013,p. 13).

A serious Chernobyl accident in Ukraine in 1986 that caused an environmental disaster on a huge territory, deaths, displacement of hundreds of thousands of people, undermined the confidence of the world community in the nuclear power.

In many countries, nuclear power development programs have been suspended, and some countries have abandoned their development plans. Nevertheless, by 2000 nuclear power plants operating in 37 countries accounted for 16% of the world's electricity production. Unprecedented efforts were made to ensure the safety of the nuclear power plants that were operated at the beginning of the 21st century. It is time for a "renaissance" in development of nuclear energy.

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IMPACT OF NOWADAYS TECHNOLOGIES ON TRANSCENDENT HUMAN'S FUTURE

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The rapid pace of arising technologies contributes to overcoming inherent human weaknesses. It allows us to tackle the future of humanity enhancement and the theme of transhumanism.

The question is, how and to what extent technology should be used in an effort of transcending ourselves. The remarkable advances in biomedical science give an opportunity to find the solution.

The urgency of the work lies in the fact that the issue is contemplated in the

context of biomedicine as the leading impetus for development of transhumanism, and its combination with computer technologies on purpose to extend human potential.

A number of scientific papers have been devoted to the problems of transhumanism, among which should be distinguished works of J. Hughes, N. Bostrum, J. D. Moreno, A. Sandberg and J. Savulescu.

Due to the improvement of technologies, it becomes increasingly important not only to eliminate human deficiencies, but also to enhance the assets that humanity already has. The analysis of connection between biomedicine and computer technologies is a necessary step towards achieving this goal.

The purpose of the report is to analyze technological breakouts of the present and predict their impact on transhumanism in humanity's development.

Firstly, let us clarify the definition of transhumanism - it is a philosophical movement that promotes an interdisciplinary attitude to comprehending and evaluating the opportunities to enhance human's intellect along with physiology by advancements in technologies.

For instance, the merger of technology and biomedicine is seen in the work of the MIT Media Lab researchers at the Center for Extreme Bionics. They developed an agonist-antagonist myoneural interface (AMI) for restoring amputees' proprioception to conquer the difficulties in controlling gestures. Artificial limbs do not give responce to the nervous system which makes it impossible to regulate arrangement, torque and pace of prothesis without peeking at it. That is why a technique of connecting nerves within the residuum to a bionic prosthesis was used to create its complex control experience. In the course of neuro-embodied design in order to augment the bilateral connections between the nervous system and the prothesis, the flesh and bone is being designed along with artificials. It will extend the synthetic world into us and our nervous system into the synthetic world, creating better communications between the designed joints and the biological body.

Another example is a wearable bionic device called “eLEGS” for patients with spinal cord injuries and pathologies that inhibit their ability to walk and stay mobile.

From roots in developing the technology to reduce musculoskeletal injuries that occur in soldiers due to lifting of loads, the Ekso Bionics' exoskeleton is the first such device for medical therapy. To act appropriately and to determine the user's general intentions a gesture-based human-machine interface is being used. Every aspect of a single stride is being facilitated as the computer draws on the user's input data in real time utilizing a series of sensors.

One more brilliant instance is the first synthetic cell created by Craig Venter's team. They started with the digital code on the computer, then built the chromosome and assembled it in yeast. After that it was transplanted into recipient bacterial cell, and the cell was transformed into a new bacterial species which became the first self-replicating species on the planet that has own website encoded in its genes and whose parent is a computer. These new synthetic DNA tools will simplify the process of making vaccines and affect diseases such as HIV that have not been possible to date because the virus evolves too quickly to keep up with those evolutionary changes.

As it is seen from examples above, technologies such as neuro-embodied design are able to end disability already in the 21st century, therefore revolutionizing medicine and health care and radically changing who we are making it questionable what it means to be a human being. Consequently, the challenge is to find the vision which will not lead to disappearance of our fundamental values, but rather to their enhancement.

In conclusion, physical limitations are one of the main weaknesses of the human. Not only they block our capabilities but also creativity, which is the main impetus of the development. Being distracted by physical inability to do something we are forced to reject achieving our goals.

The use technology for human's body enhancement will put our physical problems in the background and make it possible for us to develop with greater productivity. Transcending ourselves, humans will take control of evolution, and fulfil such scientific breakouts and social advancements that would never be possible without body augmentation.

These new technologies will free ourselves from the prison of body's

limitations, which will unlock human potential along with the torrent of the creativity and probably is going to make this world a greater place to live not only physically, but also in a context of mental health and equality.

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MAIN PITFALLS OF INTEGRATING ROBOTS IN EVERYDAY LIFE

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They were going to be the future – an army of mechanised man servants that would do everything for us. But they have not arrived yet. It is still something that science fiction has been promising us for nigh on a century – a utopian future where we all have a robot helper to take the drudgery out of life. But now the future is here – and our cybernetic servants are nowhere to be seen. To be fair, we do have some household robots – washing machines, dishwashers, and tumble dryers are commonplace. And now they have been joined by a clutch of other chore-busting machines.

That's all very well. But who really wants to fill their already-cluttered home with a legion of robot vacuums, robot floor mops, and robot trouser presses? What

we want is an all-singing robot that can do a lot. And this is where things start to get tricky. Because it means developing robots that don't just follow a pre-set list of instructions but can actually make up their own decisions as they go along. They need to be able to take a general directive. To sum up, all this requires machines that can think.

Imbuing robots with the power of reasoning is the job of artificial intelligence (AI) research. The term was coined in 1956 by MIT computer scientist, John McCarthy (McCarthy, 1969). Ever since scientists have been striving to nurture conscious thought in a machine. Independent robotics researcher, Steve Grand (Dermody, 2004), thinks the real breakthrough can only come by studying the one thing we know can think already: ourselves. Only when we understand how thought arises in a biological brain, we stand a chance of replicating the process with technology. How soon might that happen? “The trouble with breakthroughs is you can never tell,” he says. “It might be tomorrow or it might not be for 100 years.”

Creating an intelligent robot brain is not a feat easily accomplished. It's not just a case of programming robots to execute laborious and time-consuming tasks, because that has already been done, and the result is a far cry from the sophisticated, autonomous, versatile creations that scientists predicted would transform our lives. If robots are to have such a profound effect, they will need to be capable of complex human thought and locomotion.

Regarding the latter, progress has been made, and a satisfactory degree of mobility has been achieved. But autonomous mobility is not restricted to agility and balance. Instead, it combines complex skills of perception such as recognition, orientation, and navigation, which continue to be far superior in humans. This superiority is, in part, due to our evolutionary potential to adapt to a highly unpredictable and complex environment. We do this by learning from experience, which requires advanced thinking and reasoning skills. So, only by mastering these skills will a robot be able to function at a level of competence equal to ours.

Getting a computer-based artificial brain to function at the same level of sophistication is a daunting task because it will involve more than just increasing

computer-processing rates. You see, human intelligence is not limited to making computations and measuring the odds. It involves more advanced abstract applications of social and emotional intelligence which defy pure logic. Not only do these endow us with a capacity for sentiment but also for wisdom. Hence, the term emotional intellectuals. So, if robotic innovations are to play a role in areas other than the industrial sector, where human contact is of paramount importance, such as child-care and the provision of assistance to the elderly and ill, the quasi-intelligent traits of pure logic will have to be transcended.

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ROBOTIC INTEGRATION IN OUR LIFE

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We live in an age when the boundaries between imagination and reality are blurred. Technology is developing rapidly, and the field of robotics is growing with it. Different firms are constantly creating new models of robots that can take care of people, explore other planets or imitate living things. Robots are automated machines that are able to perform human functions interacting with the outside world. Robots are most often found in industry, where with their help it was possible to fully automate most production tasks. In addition, smart cars are becoming increasingly involved in the military and medicine industry.Moreover, if earlier they performed

only repetitive routine tasks according to the program, now their level has reached new heights , allowing to interact with us, communicating in their machine language, and understand our gestures and emotions. What is more, using specialized platforms, now everyone has the opportunity to influence the industry, create their own programs and add new functions to robots. Thus, developing from simple auxiliary mechanisms, robots have every chance to join our society and become our friends. There are some interesting facts from the history of the development of robots. The first who have presented a drawing of a humanoid robot was the great Leonardo da Vinci around 1495. The drawing was a model of a mechanical knight who could sit, stand, move his arms, head, and possibly grab items. Since the 19th century, inventions have become more practical. In 1898, the famous physicist Nikola Tesla introduced the public to a miniature radio-controlled vessel. Initially, this invention seemed a little bizarre. But in the future, his ideas began to be realized and gained widespread use.In the 16-17th century, in Western Europe, engineers began to design automatons - winding mechanisms, like human, that could perform fairly complex actions. The most famous of them is the “Spanish monk” robot, which was invented around 1560 by the mechanic Juanelo Turriano for Emperor Charles V. The automaton was about 40 cm tall, able to walk, beat its chest with its hand, nod its head and even present a wooden cross to the lips. More noticeable progress in robotics was observed in the 18th century. For example, in 1738, the French engineer Jacques de Vaucanson assembled the world's first android capable of playing the flute. Finally, in 1921 - the mechanisms gained a clear term “robot” thanks to the Czech writer Karl Čapek and his play entitled “Rossum Universal Robots”. Chapek called “robots” not cars, but people who worked in a special factory. However ,the term entrenched in science and gave life to all automated devices. In the mid-20th century, in particular, in the 1950s, mechanical manipulators for interacting with radioactive materials began to be developed. These robots copied the movements of the hands of a person. In 1968, the Japanese company Kawasaki Heavy Industries, Ltd produced the first industrial robot. Since then, Japan has begun to strive to become the world capital of robotics, and it succeeded. Despite the fact that the robots

were originally developed in the USA, they were imported to Japan in small quantities, where engineers studied them and used them in production.

The last five years there has been a wide surge in robotics in all sectors - from advanced manipulators to humanoids that look like living people, have a wide range of emotions and completely copy our facial expressions. Despite the usefulness of the technology, robots are not yet used everywhere, as is often shown to us in many science fiction films. This is due to several factors. Firstly, our infrastructure is simply not ready for this: roads, streets, buildings and our houses. Robots perceive the world differently and are still unable to even distinguish a chair from a table, let alone the constantly changing conditions of our lives. Robots are also actively used in agriculture. And which robots serve in everyday life? Of course, the first place here belongs to robotic vacuum cleaners, which have become indispensable assistants in cleaning the house. The leader among the manufacturers of these devices is the American company iRobot and its Roomba vacuum cleaners. As you can see, robots have already entered our lives in the form of a variety of smart gadgets, household appliances and smart systems. However, smart machines are still very far from the ideal image created by the human imagination. Every year, experts and analysts present us with a new world where faith in the supernatural will be replaced by faith in science and technology. A world in which you can study and work without leaving your home.

Robotics also affects the area of such a sensational trend now - the Internet of things. This is a single network that connects the surrounding objects of the real world with virtual ones. How this happens: Sensors are inserted into all devices connected to the network, which allows them to interact with the outside world. For example, “smart” curtains, which themselves regulate their transparency depending on the levels of external and internal lighting. Or a refrigerator that independently regulates the temperature in different compartments, based on what products you take most often.

In conclusion, Robotic devices, from the dumb mechanical ones through to artificial intelligence outsmarting humans, are spreading around the globe and into all

parts of our lives. Robots have greatly simplified the lives of people on the planet. Therefore, it is worth paying attention to this topic, and also it is necessary to further develop technologies and make our life more comfortable and better. These modern technologies are gradually uniting people and smart machines into one large social-hardware network. This is only the beginning of a difficult, but very exciting journey into the future.

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NEWEST WAYS TO SAVE AND USE HEAT

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To date, energy conservation is one of the key positions in the development and economy of markets of consumer services and materials.

The use of the latest technologies has contributed to the production of efficient and high-quality insulation materials that are unmatched by traditional means. Due to the constant rise in the price of energy carriers, the advantage of such modern materials is undoubted, so innovative development – heat-insulating paint – has become very opportune.

The energy-saving paint was first developed by NASA specialists. The purpose of the development was to make an effective surface insulator for the Shuttle series. After successful tests in space conditions, the paint was first used in industry, then in everyday life and other fields of activity. There was no need for a time-consuming process of thermal insulation. Energy-saving dyes have become a breakthrough in energy-saving technologies for thermal insulation materials.

The secret of the unique insulating properties of the energy-saving paint is

simple. This is the result of the molecular intense impact of the air contained in the resulting balls. Usually the energy-saving paint is white, and the elastic coating is formed after drying. The dye is composed of expanded perlite, butadiene-styrene latex, quartz, titanium dioxide, water, zinc oxide, and acrylic polymers. Made on its basis dye is easily diluted with water, which allows to work with the paint in rooms without additional ventilation.

Also one of the significant advantages of this material is that it does not support combustion. Its combustion temperature is 840 degrees Celsius, despite this even at such a temperature it releases carbon monoxide and nitrogen, delaying and slowing the spread of the resulting flame and smoke. That is, it is very advisable to use this paint in rooms with high fire risk, and usually there are several of such premises in large enterprises.

The energy-saving paint is used for painting metal, concrete, brick, plastic, wooden, glass, cardboard, rubber and some other surfaces. Naturally, those surfaces on which the composition will be applied must be clean, non-greasy and without rust. It can be applied on surfaces with a temperature from 7 to 150 degrees Celsius, and the operating temperature of energy-saving paint is from 47 to 260 degrees Celsius. It can be applied with a conventional spray, paint brush or roller.

Energy-saving dyes have become a breakthrough in energy-saving technologies for thermal insulation materials. But in order to maximize heat savings, not only the good thermal insulation properties alone are sufficient, it is also necessary to properly dispose of thermal energy in general. Energy-efficient heating and air conditioning systems can be used for this purpose.

Heating systems, based on the operational mode of management of heat supply, air-conditioning of rooms and their ventilation, allow reducing energy consumption significantly, even with considerable changes in requirements for comfort and microclimate both in separate rooms, and the building as a whole. Such systems absolutely rightly deserve the status of energy-saving systems.

Specific decisions in the construction of an energy-efficient heating system can be made both on the basis of the planning and design of a new industrial,

administrative or residential building, as well as on the modernization of existing ones.

The use of air heaters in the system of supply and exhaust ventilation of buildings can significantly save the amount of heat that is then used to heat the outside air. In turn, this reduces the required power of the outdoor air heating device itself and, as a consequence, its price and energy costs.

The installation of industrial waste water heat recovery systems in the industrial sector allows the return of a significant amount of heat energy to support some technological processes, such as hot water heating for the required domestic purposes and the heating systems themselves. This, in turn, reduces energy consumption and operating costs of the integrated water heating systems for industrial enterprises with a large amount of wastewater, as well as other facilities, such as laundries, swimming pools, etc., included in this scheme.

The implementation of heat recovery systems in refrigeration plants allows the use of thermal energy extracted from the condensers of the plants, for heating water, air, and for various technical purposes.

Solutions based on heat pumps in heat- and air conditioning systems allow you to provide comfortable conditions and hot water in industrial, residential and office buildings year-round. It should be noted that in the cold season this heat pump works as a heat generator, in the warm one – as a natural source of cold, and at the same time providing the production of hot water.

Energy-efficient management of air-conditioning, ventilation and heat systems is provided on the basis of receiving and prompt processing of information from temperature sensors installed in the building, as well as sensors to control the gas composition of air, etc. Operating savings in the systems of life support of premises after the implementation of this control can be up to 50%.

Therefore, it can be concluded that the conservation of heat that is used in everyday life and production is a very serious step to the economic profitability of certain processes or objects of production as a whole because thermal energy does not disappear anywhere, but only dissipates throughout space and gradually warms our

planet, and the universe. Thus, it is best to produce it as much as possible.

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WAYS OF ENERGY STORAGE

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Today, the problem of electricity production is an acute issue; but it is no less important a question of how to preserve the already produced power for its further use. And for that energy stores will be looked at further on.

Let's start with the world's initially stone energy saving facility. It was established in Altenverder, a district of Hamburg. The chief reason for the creation of this stage is its low cost compared to others and ease of procedure. At the moment, it will be tested for efficiency and subsequently put into operation.

This Heat Battery Powered by Siemens stores 1000 tonnes of volcanic rock. It is fed by heated air, after which it is fed into a stone analyzer by heating it to a temperature of 750 ° C. When demand extend peak parameters, turn on steam turbine and power is supplied to the network

"Welcome to the new Stone Age," the superscription was made on the steam plant. It is able of reserve up to 130 MWh of heat per hebdomad. The capacity of the system remains constant throughout the life cycle. The basic mission of this stage is to prove the skills of such systems to work together with the power net and recheck it at all possible stages of operation. In Hamburg, the installation will save extra energy from a local wind power plant. The next step will be to use such saving constructions in commercial projects and growth their capacity and power to sprat gigawatts per

hour.

The next invention is Tesla-based Megapack, founded by inventor Ilon Musk. The battery's size is of a shipping container.

Megapack is designed to ensure a large-scale power storage facility. Compact and transportable enough, it allows you to deploy re-establish energy quickly. This helps to support conventional power plants that connect to the network when there is a high demand for energy. The capacity of one Megapack unit is up to 3 MWh and due to their modularity it is possible to expand the station up to 1 GWh. It can be powered by both a cetralized network for the compensation of under-utilization and the shafts of alternative energy sources.

Last but not least the United States, where the world's biggest repository of power will be built. The main reason for the creation of such a project is the capacity to accumulate power for up to several seasons. The main operating company in this project are the Japanese consortium Mitsubishi Hitachi Power Systems (MHPS) and the American company Magnum Development.

The Advanced Clean Energy Storage (ACES) project will create a renewable energy saving system of 1,000 megawatts, serving up to 150,000 households annually. Advanced compressed air saving technologies, high capacity and solid oxide accumulator will be used for the progress of fuel cells.

In the western part of the United States, the demand for electricity in the daytime is quite low, leading to unstable pricing. ACES will simplify this issue by accumulating residual energy for later use.

This project will be implemented in central Utah, where there is a great potential for ACES development because of its close proximity to transportation routes and the potential for further development of solar and wind power.

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MODERN TECHNOLOGIES IN THERMAL POWER ENGINEERING

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Currently, energy conservation is one of the most important issues in the economic development of markets and consumer services. The use of alternative energy sources is becoming increasingly popular in energy-saving technologies. Solar panels, combined with the use of wind turbines, can be used as an additional source and as the main source of energy. Therefore, consumers can get rid of the centralized energy network. In addition, energy and fuel consumption can be reduced.

"Energy conservation" includes scientific and practical methods that aim at rational and economical use of energy. There are many methods that have been developed for energy conservation. All energy-saving technologies can be developed and implemented in the following ways:

- saving of thermal and electric energy;
- automation and optimization of combustion modes;
- the invention of non-power plants for electricity production;
- implementation of the latest water treatment facilities in heat sources.

As defined, alternative solar energy systems are efficient and can be installed in any region. Wind turbines or windmills can be installed and maintained in places where access is restricted, where wind gusts are 4 meters per second or less. Solar panels are an ideal option for collecting solar energy. They are used when heated to

obtain warm water.

Solar panels can be flat, basic, linear in focus, vacuum tubular and airborne. As a consequence, these alternative energy sources are well suited to maintain a positive temperature inside the building. The newest production of the fuel system, called "Renewable Oil", is becoming more popular with renewable and potential energy sources. Many highly developed countries study and work with these systems in government structures. Renewable Petroleum Systems utilize the recyclable oil that is derived from a triglyceride substance that is supplied from the agricultural economy to allow fuel production. These materials can be cereals, algae, animal fats, waste fats and oils, energy-intensive bio fuels and other components.

To conclude, the lack of energy is one of the most important factors to influence the growth of the economy. Energy efficiency can be slowed down and as a consequence, there may be even more dynamic demand for energy. In this case, a pragmatic integrated approach is needed to improve energy efficiency at different levels.

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RENEWABLE ENERGY SOURCES

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For centuries, humanity has actively used coal, oil and natural gas to meet their energy needs. Recently, due to continuous population growth, dependence on fossil fuels has become a big problem, as fossil fuels are a scarce resource. Consumption of fossil fuels causes environmental pollution. The way out was to look for alternative sources of energy.

Renewable energy is the energy from natural sources that is systematically regenerated, since it is energy from sunlight, wind, tides, etc. The main advantage of such energy is that its use does not lead to inevitable depletion of stocks. Now we are not at all surprised by the solar panels on the roofs of buildings because it is very profitable and environmentally friendly to use energy produced with the help of these batteries, especially on sunny days.

The most promising energy source is wind energy, which uses kinetics of wind energy. Wind farms are usually located in coastal areas. Hydropower plants also provide a powerful flow of energy using the potential energy of water flows. They are built on rivers in the form of dams and reservoirs. There are also tidal power plants. They are located on the shores of the seas, where the water level changes twice a day. These power plants use the energy of waves on the surface of the ocean. If compared to wind and solar, this energy gives us more power. When considering the use of renewable energy within the global electricity production system, this is almost 25%, which is a worthy result. Positive properties include the ubiquitous location and their ecological purity, while the obvious negative quality is the variability of such sources over time and the impossibility of long-term preservation.

At present, it is possible to use renewable energy sources not only of natural origin. Now scientists are developing energy from fusion and hydrogen reactions. Solar radiation, caused by the thermonuclear reactions of the Sun, has huge potential, but most of it simply reflects back into space. The most common way to convert it to electricity is to use flat collectors consisting of blackened metal panels and fluid carriers that are heated by solar ponds, which are bodies of salt water intended for collecting and storing solar energy and solar panels and other applications.

As we can see, there are many alternative sources of renewable energy that can fully supply humanity with power. At the same time, these types of energy remain natural and have minimal impact on the environment. Therefore, it is necessary to develop the future energy independence of Ukraine.

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ROBOTIC INTEGRATION IN OUR LIVES

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"We, humans have a love-hate relationship with our technology. We love each new breakthrough and we hate how fast our world is changing. Robots really express that love-hate relationship we have with technology" (Wilson, 2011).

It is a fact that technology goes hand in hand with the progress of humanity and is increasingly becoming a fundamental part of our lives to an extent of we using it not only in the industrial sectors but also in our day to day activities.

It is astonishing how technology has integrated into our lives and how globalization has enabled its expansion around the world. This has resulted in the facilitation of many tasks both in everyday life and in businesses. For example: the automation of platforms using artificial intelligence, robots that assemble countless machines, or simply the automatic programs for payments with our credit cards.

We must bear in mind that a greater percentage of the evolution of robotics is accompanied by the drastic modification and development of the Internet - a very valuable tool in today's society. The Internet is very essential. It opens the door to an unlimited world of technology in just a click. And this is in a progressively constant evolution just as the human race.

One of the greatest ways in which robotics has been integrated into our lives is undoubtedly through medicine, where great advancements have been made over the years. The creation of robotic surgical machines which has aided in undertaking operations with minimal demerits to the patient, 3D printers in which countless prostheses are manufactured in a more accurate and fast way, the creation of machines for making new and more complex medicines among others are the mind blowing integrations of robotics into our daily lives.

Large companies such as Google, Tesla, Amazon, Apple have focused on the development of multiple tools that allow to advance in technologically leaps and provide a new lifestyle of contemporary human life with products such as: electric cars with zero CO_2 emissions, self-driving cars, cell phones and computers with artificial intelligences and great power to perform tasks with high speed and focused on our tastes and needs, space shuttle projects etc...Viewed from this point, robotics is sufficiently satisfying the world and is influencing both production and work processes such that agriculture, accounting, assembling of products among quite a number of jobs which needed man to finish some time ago no longer has them considered. This situation has pushed man to a secondary plane since automated robots do all the work, leaving many workers and others simply unemployed or in supervisory positions.

Of late, great doubts grow among many philosophers and scientists. They pose themselves with quite a number of heartbreaking questions. They say: “Will we become completely supplanted by robots with artificial intelligence and self-autonomy?”, “will robots have so much autonomy that they will be revealed to the human race?” Selinger E. & Hartzog W. (2015). These among many other rhetorical questions are being asked while robotics and technology undergo development and modification.

Nevertheless, technology has not only been used in the positive favor of science as the examples already mentioned, but also in the arms race for several decades. The development of remote-controlled missiles to the use of autonomous drones for airstrikes and invasions, the creation of artificial intelligences and software for spying and theft of computer data, which has become very common and dangerous since these tools are not only used by security personnel for good but also by great computer thieves to cause harm to people.

Robotics in principle is a very powerful tool, but a double-edged sword at the same time, in as much as robotics is very beneficial to our daily living both consciously and unconsciously, it could be hazardous to the human race. It could be a serious weapon of destruction to our civilization if not kept under control.

Imagine a dystopian future in which robots overtake us and reveal themselves to us by breaking the laws of robotics proposed by Isaac Asimov who states that:

- A robot will not harm a human being or, by inaction, allow a human being to be harmed.
- A robot must comply with the orders given by humans, except for those that conflict with the first law.
- A robot must protect its own existence to the extent that this protection does not conflict with the first or the second law (Asimov, 1982)

I would like to conclude with a question that has been around my head for a long time. Is robotics the real solution to humanity's problems or is it the pathway to the demise of our civilization?

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INFLUENCE OF GLOBAL WARMING ON LIVING ORGANISMS

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Nowadays the problem of global warming is widely spread. It has some influence on both the structure of the planet earth itself and on the organisms that inhabit it. For example, scientists from Rutgers University did a research in the ecosystem of marine and terrestrial life to obtain a lot of information on the effects of climate change. Frankly speaking, it does not bring any benefits but only harms nature.

By calculations, 88 marines and 294 land species have safe conditions for living during the hottest seasons of the year. However, Pinsky at el (2019) noted that marine inhabitants are being affected by extreme hot temperatures twice as often as land species. Also, a great number of extinctive sea creatures have a significant impact on the people that rely on them (Pinsky at el, 2019).

Another research on the influence of global warming on habitants was conducted in Yellowstone park. A woman-graduate from Stanford University spent 3 months in a remote area of the park searching for rare frogs and salamanders. The results were quite shocking – she claimed a big catastrophe of decreasing animal population (McMenamin at el, 2018). In fact, the amphibians need water resources to hatch their eggs, and because of drying water their babies die.

In my opinion, we must care more about our nature by employing such methods as decreasing the amounts of exhaust gases, trying to turn to electric vehicles, and harnessing alternative source of energy on a large scale.

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UNMANNED VEHICLE

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How many disputes are on unmanned vehicles! Someone thinks that they are a great idea and believes that they will flood the whole world in the closest future. Opponents, by contrast, call the automobile autopilot a dangerous technology that can't replace human beings.

However, reality is probably not so clear, and the truth, as always, somewhere in the middle.

But in order to understand how to make a personal opinion about autonomous driving, you should know basic things. One of which is the understanding of levels of automotive autopilot.

Especially that today we are regularly confronted on the streets with cars, endowed with a certain level of unmanned control. In the closest future the quantity of these cars will be greatly increased.

The classification of levels of unmanned management was developed by the American society of automotive engineers (SAE International) and called the SAE scale. It was first published in 2014. Firstly, the classification was adopted by the Ministry of transport of the USA and later – the United Nations. Now, this scale is generally accepted.

Autopilot 0 – "automation-free". Automation: absent, man must do everything.

Autopilot 1 – "legs-free". Automation: automation not just notifies the driver, but intervenes in the management and assistance.

Adaptive cruise control – keeps a safe distance between your car and vehicles

in front, the car slows down and accelerates when required by traffic conditions.

Autopilot 2 – "hands-free". Automation: at the 2nd level of unmanned control automotive autopilot controls the machine, accelerating, braking and steering. However, although this level of autonomy is called "hands-free", this does not mean that the driver can go to sleep.

Autopilot 3 – "eyes-free". Automation: at the 3rd level of autonomy, the machine will take full responsibility for the management at times. In fact, it is already not only the use of lidars, radars, cameras and sensors, but also of artificial intelligence.

Autopilot 4 – "driver-free". Automation: fully autonomous vehicle that does not require the driver and controls.

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ADDRESSING THE GLOBAL WASTE CRISIS

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In American animation Wall-E was a little cute robot that cleans up all the waste that mankind had left. Nowadays all of us is in danger and fictional future can come into reality.

Ten years ago cities generated 680 million tones of solid waste a year, says the World Bank. Now this is 1.3 billion tones. (Belton, 2016. "Can technology help tackle the world's waste crisis?")

In Ukraine there important is a problem with wastes. Old factories, the war in the east, misuse of resources, environmental illiteracy of our society, the Chernobyl

accident caused catastrophic changes in nature. However, Ukraine is not solving this problem. Therefore, I think that we must study modern methods of recycling from the leading countries.

There are bins with RFID (radio frequency identification) tags have been used control recycling waste in Australia and Portugal. It contains many sensors which works like this: if someone put the garbage into a bin then every sensor begins to work; sensors calculated percentage unsorted garbage and IR sensor sends the information to the people who are responsible for that particular area or district, they can take immediate action to prevent a squashing of that “smart” bin. (Somu Dhana Satyamanikanta, M.Narayanan, 2017. “SMART GARBAGE MONITORING SYSTEM USING SENSORS WITH RFID OVER INTERNET OF THINGS”)

Another one problem is e-waste like microchips in electrical appliances. But not so long ago it turned out that silicon is soluble in water. So scientists are working on electronic chips that can be dissolving in water.

In Australia, technologies have been developed to build micro factories that process garbage into materials that can be used in industry. These factories can be located on area about 50 square meters, where is concentrated a lot of waste. Factories are a group of modules that perform different functions. First, the electronic garbage is placed in a module that breaks them down, and then the robot selects useful details. Another module is equipped with a muffle furnace in which metals are melted to extract valuable alloys, the next one processes plastic into high quality thread. These technologies will not only improve the environment, they are cost effective. (Veena Sahajwalla, 2018. “With incentives, industry could tackle Australia's waste crisis”)

Plastic, E-waste, industrial waste has a negative impact on the environment. Without urgent action to arrest the problem, there will be, as research shows, more plastic than fish by weight in the oceans by 2050. In the future it will cause human diseases. (Brahma Chellaney, 2019. “Pathways to tackling the plastic waste problem”)

To sum the global waste crisis problem is common in different branches of

manufacturing. So this problem needs to be solved immediately and Ukraine must join the leading countries.

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ENERGY-SAVING PLASTIC WINDOWS

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Plastic windows with energy-saving double glazing are increasingly often installed by residents of our country in their homes. First of all, it is caused by rising energy prices, which happens quite often. After all, many people already know that the energy-saving function of plastic windows can significantly reduce electricity and gas costs. Comparing the first plastic windows that appeared on the Ukrainian market, their quality was lower and the windows themselves cost more than today's ones.

How are energy-saving windows different from regular ones? The first thing that combines these two categories is the material the profile is made of. It is essentially the same plastic (polyvinyl chloride). But there is one "but". The difference here lies in many parameters: country of manufacture, manufacturing

technology, quality system and control.

In the window business, all the details are particularly important and perform their function. To begin with, it is important to clarify what the main elements of the window are – it's profile, double glazing, and accessories. The energy saving of the window structure depends on: the window profile; double-glazing; quality of the installation of the window structure.

The principle of creating an energy-saving double-glazed window is to apply a special coating on the surface of an ordinary window glass by magnetic sputtering. Made with this technology, the energy-saving double-glazed window works as a kind of heat valve – it transmits outside heat to your house and displays it as a mirror, preventing it from leaving the room, and thus, preserving heat and family budget.

Energy-efficient metal-plastic windows, in which the double-glazed cells are filled with argon, increase the heat transfer coefficient by 5%. Argon windows have improved sound insulation and low risk of condensation. Their service life is 20 years.

Krypton-filled energy-saving windows conserve heat better by 80%, similar to argon, and better than air by 160%. Krypton is non-flammable, non-poisonous and absolutely safe because it is contained in the air. The sound insulation characteristics of plastic windows with krypton are also higher. Their service life is 29 years.

The easiest way to test energy-saving glass is to raise a match flame or a lighter to the window. There should be several reflections of fire, one of which will be different in colour. If all the lights are the same in colour, the double glazing is normal.

By installing energy-efficient windows in your home, you can save significantly on space heating; create comfortable conditions in the room, which is a good mood and a long healthy life; protect against ultraviolet radiation, which will have a positive effect on the health of the eyes, and also it will help to avoid burning of interior objects, walls, paintings, wall-paper.

The main function of energy-saving glass is reflection. It provides a comfortable temperature in the house. In the summer, the window reflects the

scorching sun rays to the side of the street, providing coolness indoors. In winter, the heat reflected from the appliances back into the house doubles their benefits.

Therefore, the advantages of installing energy-saving plastic windows are a comfortable temperature throughout the house all year long and significant cost savings by reducing gas and electricity consumption.

However, there is also one downside – the coating applied to the glass is not eternal. However, with proper window care, energy-saving coatings will last for many years.

To sum up, it must be said that the emergence of a market for energy-saving windows has revolutionized consumers' perception of plastic windows. Energy-efficient plastic windows are a significant component of comfort in a home and, of course, a significant saving on heating.

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GLOBAL WARMING

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Global warming is temporary or constant changing climate and temperature of the Earth's climate system. Needless to say that it's very dangerous human-caused phenomenon. Unfortunately, our technical progress, factories, human activity are the key reasons of the increase of "greenhouse gases". So what is "greenhouse gases"? How are they connected with global warming?

Greenhouse gases are so-called gases which absorb and emit sun radiant energy. Greenhouse gases cause greenhouse effect. If concentration of those gases were acceptable, this effect would not cause any problems to our nature. But human activities since the beginning of the Industrial Revolution (around 1750) have produced a 45% increase in the atmospheric concentration of carbon dioxide (CO_2), from 280 ppm in 1750 to 415 ppm in 2019 (Greenhouse gas, 2019). Thus, that is the main reason of global warming.

It is evident that consequences of global warming are irreversible, serious and terrifying. First of all, glaciers are melting and sea level is rising. The temperature increase leads to reduction of glaciers. Secondly, a lot of animal species couldn't adapt to changing their habitat. Consequently, many species might just die out. Finally, natural disasters will happen more and more often, such as drought, flood, hurricane, pouring rain etc.

Nowadays, scientists are looking for possible solutions of this problem. It is undeniable fact that we should do our best to reduce amount of exhaust fumes given off to the atmosphere. Subsequently, conventional sources of energy are to be replaced with renewable ones, electric power has to substitute petrol and diesel fuels. In addition, amount of toxic waste must be reduced or even dramatically minimized by sorting and recycling of rubbish. All factories and enterprises ought to control their toxic fumes given off to our environment.

To sum up, it is necessary to mention that global warming is one of the most pressing ecological problem, which demands fast and smart solution. Hence, we should be more responsible and less apathetic because our future depends on us.

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NEW TECHNOLOGICAL BREAKTHROUGHS IN CHEMISTRY

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Undoubtedly, science, is like a live organism, does not stand still, but it is developing, bursting with new discoveries, theories, hypotheses. Not being an exception, chemistry is increasingly replenishing its stock of knowledge with new ideas, facts, discoveries and inventions. Throughout its existence, chemistry has always been and continues to be a great help to human beings in their practical activities. Without chemistry, it is impossible to develop many industries such as: fuel and energy complex, metallurgy, transport, construction, electronics, household spheres, etc. We are firmly convinced that modern discoveries in the field of chemistry will help people to reach a higher level of development in all spheres off their life and activity.

To confirm this opinion, we will present an example out the invention of the Nobel laureates - John Gidenaf, Stanley Wittinhel and Akira Yoshino, who made a breakthrough in the creation of lithium-ion batteries: anodes on the basis in carbon

black formed by the decomposition of carbohydrates. This increased the possible energy consumption off the batteries. Batteries have become safer - researchers have reduced their risk of explosion. Lithium-ion batteries have become an important part on the revolution of mobile devices also the gradual development in electric transport. As a result of this breakthrough, there is an increase in the comfort with life and a reduction in the negative impact since humanity on the planet.

To prove this point, I will present the research of Francis Arnold, Gregory Winter and George Smith. Arnold first performed protein synthesis to increase its activity. Together with mapping the antibodies also peptides of Winter also Smith, this achievement should help create environmentally friendly fuel and even new drugs.

Summing up all mentioned above, we can conclude that chemistry is rapidly developing. Increasingly, new discoveries are emerging that are aimed at creating a comfortable life, helping people to fight incurable diseases, also reducing the harmful impact on nature and environment. All this will help people to move to a new and better standard with.

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THE QUESTIONABLE PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Since ancient times, people have wanted someone else to do their work for them. It all started when ancient people began making some tools that partially helped them get the job done. Then people tamed the animals, which they also involved in

work. What caused these events? It was a desire to make the job easier or outsource it to someone else.

Sloth is the engine of progress. It was because of the laziness that inventions began to emerge, performing part or all of the work. In our time, such a discovery is artificial intelligence, which has many applications: from tiny noise-canceling headphones, which can be used during a telephone call, to huge rooms with high-performance server computers (which carry out complicated calculations). Recently, people like the topic of artificial intelligence discussions that the tech giants that started to introduce it could not fail to notice. Everyone has probably heard such words as a smartphone, a smart watch, or even a smart toilet bowl that seem to be endowed with artificial intelligence. They all have some unusual, possibly useful features, but it's really just a chip for the sake of a chip. Marketers are trying to prove the usefulness and need of these products, though they really just want to sell them to us. Also, remember when you search for a product in online stores, you will see the advertisement for this product on various sites. These are all the results of artificial intelligence (Artificial Intelligence or Artificial Hype: How Ukraine's Top Innovation Looks Like, 2018). Therefore, artificial intelligence is hardly improved because it is not profitable. True artificial intelligence will not appear in our daily lives as long as people let themselves be deceived and buy much-needed smart electronics. Many companies are deliberately hampering the development of technology because they realize that in the near future, they will not introduce any new products. And until the development of technology ceases to manipulate money, we will not see real progress in everyday life. There may already be prototypes of full-fledged applications that can process and use information for some analysis but will not be used by ordinary people until it is beneficial to someone. Of course, there are already smart electric cars that can safely and independently drive people on roads with other cars that are driven by people, while obeying the rules of the road. This is more of an exception to the rules than a trend of development.

Although a person has the intention to create something smart, useful and independent, it will not happen until it is beneficial to someone.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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History

Artificial Intelligence is one of the most interesting ideas of man. Many dissertations and even more works in the genre of science fiction have been written about it. And still, there is still no consensus on what Artificial Intelligence is or should be.

In 1937, Alan Tjuring announced his invention - the universal Turing machine, in 1939 the first mechanical man Electro with the Sparco dog was introduced in New York.

Before 1949 it was still impossible to realize the idea of Artificial Intelligence, because the computers of that time could not save the commands. They could only execute them. It was also extremely expensive.

The next stage in the history of artificial intelligence is the 50s, when researchers tried to build intelligent machines by imitating the brain. These attempts were unsuccessful due to the complete unsuitability of both hardware and software.

Then in 1955 the first program appeared, based on the concept of Artificial Intelligence. Its name is "Logic Theorist". It was created by Herbert Simon, Allen Newell and John Shaw and first introduced in the summer of 1956 at a conference at Dartmouth College, which was dedicated to Artificial Intelligence. But the program was coldly received by the public. Despite the failure, this event gave an understanding that this is possible.

As it usually happens, “future creators” from the very beginning were divided into two camps: cybernetics and neurocybernetics.

Cybernetics immediately abandoned the idea of a complete copy of the mental processes of man. It is enough for them that the device and the person give the same answers (output data) to the same questions (input data).

As soon as computers became widespread, cybernetics mastered them and immediately set to work. They started with small games. Toys were like tic-tac-toe, Scrabble and others, where the computer calculated by brute force. When an answer was found, the search ceased, and if not found ... There was a combinatorial explosion. As time went on, technology developed. And so, in the first half of the 70s, more interesting systems began to appear that were able to recognize a natural language and communicate on it. One of the first in this area is SHRLDU, created by Winograd in 1972.

It understood a decent amount of English words, limited by the scope - the world created from the details of the children's constructor. The entire vocabulary, all the questions that could be answered in a normal way, were connected only with this world. Other similar systems were also limited by some field of application. There was no talk of self-learning.

Later, more advanced systems appeared that could support conversation on almost all topics. But this can only be said with a big stretch, since the ownership of the topics was quite superficial. If you ask a question requiring deeper knowledge or a difficultly formulated question, then the program refused to perceive it and began to repeat after you, constantly asking again.

AI in use

Today it’s hard to imagine a field of activity in which various smart devices spread simplifying out work or taking on part of our responsibilities. Among such areas are medicine, education, business, science, entertainment, crime prevention, the solution of numerous domestic issues.

Medicine

Currently, in Colorado hospitals, remote monitoring systems are used to

monitor patients with an increased risk of falling: those who have had a stroke or surgery, etc. It turned out that remote monitoring from UCHealth is as effective as the classic work scheme, in which paramedic is attached to each room. If the patient doesn't answer the operator's questions or doesn't fulfill the requests, a nurse is sent to the ward. In addition to simple observation, artificial intelligence tracks the sympoms of sepsis in patients. Sepsis is one of the most common causes of death in hospital patients in the United States. The algorithm that defines the criteria for diagnosing this disease has reduced the time to determine sepsis by more than two hours. The computer determines the early stages of the disease: a high heart rate, fever, rapid breathing. This computer monitors not only the basic vital signs, but also analyzes the results of laboratory tests, comparing the patient's medical history with those that are already in database.

Marketinng

AI was introduced into one of the American zoos. If before the introduction of the system, the zoo's work was based onn the assumptions about how many visitors will come to the zoo on each particular day, then with the inclusion of AI, the forecast began to take into account the number of potential and current visitors' chekins on social networks, mentioning the name of the zoo on various resources, weather forecasts and much more.

As result ticket sales grew by 700%, due to more accurate and forward-thinking planning, annual personnel costs were reduced by 10%. The number of participants in the loyalty program increased 3 times – thanks to the rapit creation and conduct of targeted marketinng campaigns.

Prospects

Today, the development of artificial intelligence is at a tremendous pace. It has already found application in many industries. Despite this, its potential is not yet fully revealed.

Here are some of the areas:

Neural networks

This direction is steadily held in first place. The improvement of real-time

learning and classification algorithms, processing of natural languages, recognition of images, speech, signals, as well as the creation of models of an intelligent interface that adapts to the user, continues. Among the main applied problems solved with the help of neural networks are financial forecasting, data mining, system diagnostics, monitoring network activity, data encryption.

Image Processing

The development of methods for presenting and analyzing images (compression, encoding during transmission using various protocols, processing of biometric images, satellite images) will continue, independent of playback devices, optimizing the color representation on the screen and when printing, distributed methods for obtaining images.

Further development will be provided by means of searching and analyzing the meaning of images, matching the contents of reference catalogs with automatic cataloging, organizing copy protection, as well as machine vision, image recognition and classification algorithms.

Expert systems

Demand for expert systems remains at a fairly high level. The greatest attention today is drawn to decision-making systems on a time scale close to real, means of storage, extraction, analysis and modeling of knowledge, dynamic planning systems.

Intelligent applications

The growth in the number of intelligent applications that can quickly find optimal solutions to combinatorial problems (arising, for example, in transportation problems) is associated with industrial growth in developed countries.

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WIRELESS CHARGING

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Wireless charging is a new technology developed back in 2009, which has begun to spread widely only in recent years. It works with the help of electromagnetic induction, where the panel on which you want to put the phone acts as a transmitter and the phone as a receiver.

The "QI" standard was introduced with the corresponding marking for devices, with which you can determine whether the device supports the function of wireless charging or not. Based on this technology, devices have been developed that charge phones and tablets without contact but at short distances (only a few centimeters). This is very convenient, because you do not need to look for a free outlet and wire, but the outlet is needed for the charger, although there are already options with a battery, which allows you to recharge your phone without an outlet and wires. Thanks to this technology, a person can use his device while charging

without fear of damaging the cable or connector. True flaws also exist. This is low speed and efficiency. It is worth noting that the speed is gradually increasing. Today, there are three widespread variations in charge power: five watts, seven and a half watts, and ten watts. The second and especially the third option is far from suitable for every device, especially when you consider that there are not so many devices with wireless charging support now.

However, there are accessories that allow you to charge a significantly large number of different devices wirelessly. Now this technology is just beginning to spread and probably in a few years, charging with a wire will become a rarity.

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SMART GRID

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Smart Grid is an infrastructure that allows both suppliers and consumers to acquire the energy information they need in real time and use this information to enable supply, storage, consumption, and transaction of energy in the right amount at the right time.

The main components of Smart Grid:

- Smart Power Grid, or a hardware infrastructure network (substations, power transmission and distribution lines) enables energy sharing between suppliers and customers;

- Communication Network, which enables sharing the information about energy supply and demand. It consists of information channels, fiber-optic cables, mobile operator infrastructure, etc.
- Financial Network that enables precise transaction by quantifying energy value into price.

The electricity market of the smart grid pilot project uses an investment model, and market operating system provides an environment for two-way real time electricity trades. Whereas the existing electricity market revolves around a supplier-centric one-way trading system, the smart grid electricity market is given by two-way trading mechanism between suppliers and consumers and involves different resources such as power battery storages, virtual power plants, and demand reduction.

What Smart Grid can give us?

- Improving of energy efficiency. Enabling two-way real-time sharing of power information between a supplier and consumer, smart grid ensures maximum efficiency in energy usage. The real time pricing takes into account the electricity market price and system operating costs in real time and, therefore, induces consumers to use power wisely. This change of power usage, in its turn, influences the market price and creates a virtual circle of investment. The real time pricing also applies price for TOU (time of use pricing), CPP (critical peak pricing), RTP (real time pricing) and provides consulting services maximizing costumer participation in the smart grid.
- Motivating voluntary improving supply-demand conditions. Smart grid naturally diffuses energy demand by channeling it toward low-rate hours, and encourages voluntary energy conservation by showing consumers usage volume and rate in real time.
- Solving the problem of stable co-usage of traditional and renewable green energy, such as wind, solar, which is prone to irregular generation volumes. Renewable energy sources such as photovoltaics and wind power, smart homes and buildings and electric vehicle charging stations are connected to the power system through two-way communication. Grid operation automatically identifies the most

optimal operation environment process to improve efficiency. The real time system for photovoltaics and wind power using weather information can project the renewable energy sources 48 hours in advance. This projection helps the grid operation to be prepared and take full advantage of circumstances. The TCO control room manages power equipment including the communication network monitoring sensors and diagnostic devices.

Smart power grid improves the quality and reliability of electric power for the advance detection and control of different parameters. The TOC monitors and analyzes the data sent by each consortium in real time. System is also capable of identifying operational abnormalities and sending signals to the appropriate operation center in charge (Smart Grid Technology, 2013).

Here are examples of different Smart Grid Solutions:

- Smart Buildings, Smart Houses. A Green Building that maximizes the energy efficiency through low-carbon green energy resources and energy efficiency system reduces CO_2 emission and minimizes the environmental pollution by applying environmentally friendly devices (Smart Grid, 2012).

An environmentally friendly household provides everything necessary to maintain the complete comfort in residential environment through application of low-carbon green energy resources and AMI to maximize energy efficiency.

- Smart Transportation. EV (Electrical Vehicles) infrastructure:

1. EV quick charging. EV infrastructure is used for rapid charging at EV quick-charge stations and short-term parking lots at restaurants, stores, theatres, etc.

2. Home-based EV slow charging. Infrastructure consisting of 220V power sources is installed in individual homes for easy and convenient charging.

3. Office-based EV slow charging. This infrastructure is meant for those who drive to work, with small chargers installed at company parking lots for recharging during work hours.

4. Battery rental and replacement. Infrastructure for renting and changing batteries is used to instantly re-supply power, thus complementing the lengthy charging time required for EVs.

- Substation Automation System (SAS). SAS exercises real-time monitoring and unmanned automatic operation of substations by using digital relay.

- Supervisory Control and Data Acquisition System (SCADA). SCADA is the real-time monitoring of distant on-site equipment from the control center by using a remote terminal unit (RTU).

- Distribution Automation System (DAS). DAS is aimed at monitoring of distribution line switchgears, identification and recovery of malfunctions.

- Power Quality Monitoring System (PQMS). Real-time management and analysis of power quality through the installation of PQ meters in main power supply systems are exercised by PQMS.

- Advanced Metering Infrastructure (AMI). AMI is the core infrastructure for realization of a bidirectional communication-based information supply system and Smart Grid demand response (DR).

- Energy Management System (EMS). EMS is a large-scale power system control center that carries out economic load dispatch via effective system management.

- Electrical Equipment Control & Monitoring System (ECMS). Operational management and control of electrical equipment are put into effect by using digital relay.

- Power Monitoring System (PMS). This system monitors electrical equipment of individual factories and buildings.

- Security control. As the smart grid incorporates various information technologies into the power grid, the possibility of series cyber damages, such as massive power outages and customer information leakages, always exist. The integrated security control center includes detection system, abnormal traffic control system, and network database access control system. These systems work interactively to create an integrated security control system that encompasses the entire network and system of smart grid as well as the users.

Additionally, national intelligence services and other responsible organizations collaborate to respond and take actions against cyberattacks in real time.

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3D PRINTING – INNOVATION AT ITS BESTS

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3D printing is an innovation that enables people all over the world to develop their own custom products. A few years ago, a 3D printer was a technological novelty. But today it is a widely used tool for a lot of things in different fields of technology.

The idea of 3D printing was proposed in the 80s of the XX-th century. However, a 3D printer of sufficient quality appeared only in 2005 (The History of 3D Printing, 2019).

1988	Scott Crump created layering technology. It is the simplest and most popular technology that is steel being used now.
1986	Charles Hull created stereolithography technology.
2005	Z Corp. has created a first 3D printer.
2013	WobbleWorks has created a 3D pen

3D printers operate on different technologies but perform the same functions. All modern 3D printing technologies are based on layer-by-layer object formation like:

1. Fused Deposition Modeling (FDM)
2. Selective Laser Sintering (SLS)

3. Stereolithography or "SLA" printing

FDM technology was invented by Scott Crump. This technology works on a rather simple principle which reminds the work of a sewing machine. That is why 95% of all modern 3d Printers use this technology. By the way, such printing allows using not only plastic, but also any material that can melt and solidify: cheese, chocolate, latex rubber, silicone, ceramic and cement masses, even silver and gold in the composition of clay (What is 3D Printing, 2019).

SLA technology is very expensive and is used little. But it gives a very high accuracy of printing. The basis of SLA printing is the influence of a laser or special projector on a liquid photopolymer. The laser beam illuminates the area where the walls of the model will be located. Under its influence, the liquid solidifies, and the solid layers of the model lift up. This process is repeated until all the layers have been printed.

SLS technology bakes special materials with a powerful laser. This technology allows you to work with ceramics, plastics, glass and more. The laser can also bake a mixture of metal powder and special glue.

In addition to 3D printers, there are also 3D scanners. They explore physical objects and then reproduce their exact models in a digital format (8 Great Innovations, 2019).

3D-printer requires a special 3d-model for printing. 3d Models are created with special software for modeling and design. 3D models can be created by a person manually or automatically with special programs. The most common free 3D modeling software: *Blender, 3dsMax, cinema 4D Studio, Sculptiser* and others. There are also services for online modeling 3D objects – https://www.tinkercad.com/ and https://www.vectary.com/.

Nowadays 3D-printing is useful in different directions. 3-D printers are being used in medicine & Bio-tech (While the technology is far from perfect, 3D printed organs are already on the horizon.), **On-Demand Production & Design, Drones & Aeronautic Parts, Homes & Emergency Shelters etc.**

3D-based business is a great way to start your own business. A three-

dimensional printer can be purchased for a relatively small price (UAH 20,000). The necessary material for printing (mostly plastic) costs from 700 UAH up to 2 thousand per kilogram of raw materials (3D Printing in Business, 2019).

In conclusion, I can say that 3D printed cars, drones, electronics, planes, door knobs and all kinds of products we had never had before might very possibly be used in the future and be available, customizable and affordable. The 3D-printing world is exciting and innovative. For better or worse, it can change lives, industries or even the world.

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QUANTUM COMPUTER

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There is no doubt that we get used to all conveniences what we have nowadays. Modern technologies improve our life and make it easier that's why we have more time on more creative things. Routine work makes us less creative, like robots we wake up in the morning and doing our duties all day long. Some people think that innovations make us less adapted to the difficulties in our life. Whether we want it or not, but we addicted to computers and technologies. Computers improve every day,

abilities what we have now, two decades ago was like a kind of fantastic theory. With the help of a computer, we can solve difficult algorithms that impossible for the human being. One these outstanding computers is a quantum computer.

To begin with, a Quantum computer is a new kind of computers that can calculate the algorithms in a different way. Quantum computer creates new possibilities and new ways to approach problems that classic computers have difficulty doing. It can be useful in science, medicine, to diagnose illness earlier, in architecture, to make more practical buildings. All computers have the ability to store information. Modern computers use bits, which store information. Quantum computers use quantum bits or qubits. To work with qubits for a long period of time, they must be placed at a very cold place. It has refrigerators which cool down the system if it is getting hotter. There is nothing perfect so like a usual computer it has some disadvantages. For example, little heating in the system can cause errors that's

why quantum computers work at a temperature close to absolute zero. Moreover, this kind of computers is very sensitive to noise, environmental effects. Last but not least, this machine occupies quite a big amount of space but it is certainly become smaller in the future and will be like a laptop or a personal computer

In conclusion, Quantum computers are smarter usual ones. It has some disadvantages but it is a matter of time how fast they can be solved. In a few years, it will be the most amazing discovery what humanity has ever seen. With the help of these computers, people can reach enormous results in the different fields which will help the human being and our planet.

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GLOBAL WARMING: PROSPECTIVE SOLUTIONS

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Global warming is the gradual increase in the average annual surface temperature of the Earth's and the world's oceans, due to all sorts of causes (2).

Too often the "greenhouse effect" is used as an equal for global warming but there is a difference between them. The greenhouse effect is an increase of an average temperature of the bottom layer of the Earth's atmosphere and the oceans due to growth of greenhouse gases' concentration in the Earth's atmosphere (4). These gases are like a glass in a greenhouse: they freely let the sun's rays through themselves the to the Earth's surface and keep the heat that is about to leave the planet's atmosphere (3).

Global warming and greenhouse effect were discussed in the 1960s and global climate change was firstly determined as a global problem at the UN summit in 1980. Since then, many scientists have been trying to solve the problem, often refuting each other's theories and assumptions (3).

In October 2018 the IPCC (The Intergovernmental Panel on Climate Change) issued a special report (1, 3) on the impacts of global warming of 1.5°C, finding that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society. The report also highlights a number of climate change impacts that could be avoided by limiting global warming to 1.5ºC compared to 2ºC, or more (5).

But there's a lot of non-profit organizations who contributes a lot to solve the problem of global climate changes. One of these organizations – "Project Drawdown" – has made at least 50 exploration for overstepping the barrier of global ecological problem. They have developed their own to-do list which includes 100 items and called to show us how we need to act and what we need to accomplish to overcome our problem in the next 100 years (6).

Here are some of the technologies we can use to get over global warming.

Biochar – planting the plants which can catch carbon from the atmosphere and store it in the soil or even in their own bodies.

Solar Farms – building clean power plants on the areas which aren't being used. These buildings can produce up to 40% of all energy we consume.

Green Roofs – creative solution for big cities and towns. As we know, trees absorb water and carbon dioxide to produce oxygen and cellulose. So, once we cover every rooftop in the big cities by trees, we'll receive increasing of world's oxygen production by 10-15% and lessen the carbon dioxide concentration in atmosphere.

Smart Glass – is an invention whose main role is to decrease amounts of incoming solar energy in our rooms and offices in the summer and increase energetic efficiency of regular windows. This way we can lessen our requires in conditioning air, thus decrease energy consumption for these purposes.

Bioplastic – making the materials which are alike our modern plastic but have some differences between it – this plastic can decay in the soil without producing any toxic compounds. Using this technology, we can prevent the formation of gigantic rubbish mountains which, basically, occupy a main part of our continents' area.

Recycled Paper – recycling the paper which has been used. This way we prevent cutting forests and lessen the emissions of greenhouse gases which, by the way, form when we burn used paper.

Telepresence – instead of live presence using wireless connection technologies. No more required business trip – lessen number of flights – decreasing carbon dioxide emission and fuel use by 5%.

Landfill Methane – catching methane, produced by landfills and using it as an alternative and clean fuel.

Though the climate on the Earth wasn't constant, we had just understood that we've changed it and corrupted the natural ecosystems' integrity.

Enormous amounts of greenhouse gases emitted by human activity have caused the global warming – increasing of average annual temperature in the surface layers of Earth's atmosphere.

And lately we have been making a great to solve the problem which is about to become global disaster: global organizations, like the UN, have been trying to draw the attention of the society to this problem; volunteers from all around the world are making their own attempts to lessen the harmful influence of human's activity on the nature. Their work is priceless but ignored by some countries' governments and societies as well. Due to this, solving the problem is snoozed on a long-term prospect.

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ROBOTIC INTEGRATION IN OUR LIVES

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In modern world we everyday use a big number of different electric machines which help us to make our lives easier. Among a variety of different devices, the word robot has become ordinary for us. Robots are used for the completion of many tasks which are boring or dangerous for people. It's obvious that robots affect our routine and productivity of service. So, how robots influence the modern world? This article is created to answer on this question.

The topic of this abstract is to describe different types of robots which were integrated in our lives up to present and how they can be used into our lives.

Robot vacuum cleaner is extremely popular among modern people. This type of robot clean floor in house without help of human. Robot vacuum cleaner cleans the floor automatically and do it does it until the moment when the battery is discharged, but this robot drive to the charge station by itself. There are a big number of cooking robots which can cook without the help of human. Thanks to this robot you don't need to spend your time on cooking after hard-working day. You only need to choose the recipe for automatically cooking. Everything else will be done by the robot. Many cooking robots can remember your movements when you cook and copy them to make food similar to yours. This type of robot cooker is installed in many houses and hotels (Staples, 2018).

Robots are widely used in the military. They always do work which is very hazardous or difficult for people such as arming and disarming bombs or monitoring enemy's activity. Moreover, robots help people to monitor their houses on departure and monitor different places from faraway location (STUFF, 2018). With the help of robots you can secure your house from being damaged if you are not there.

To sum up, robots become an inalienable part of our lives. With their help we can make our lives easier and safer. With the progress of modern technology concentration of robots in our routine will increase.

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CURRENT TRENDS IN RENEWABLE ENERGY SOURCES INVESTMENT AND UTILIZATION

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Renewable (or alternative) energy sources are solar, wind, hydroelectric, biomass energy, geothermal energy etc. These energy sources can be implemented for houses, cars, factories and other facilities. In comparison with non-renewable energy sources, renewable energy sources cause much less harm to the environment.

Nowadays solar energy is considered to be one of the most promising and popular renewable energy source. Solar energy is energy that is obtained from the Sun by means of collecting solar radiation and its rays. Solar panels are used to get energy from the Sun, but the general disadvantage of this energy source is that we cannot install photovoltaic cells everywhere. Solar panels also can't generate electricity in night and in presence of overcast weather conditions.

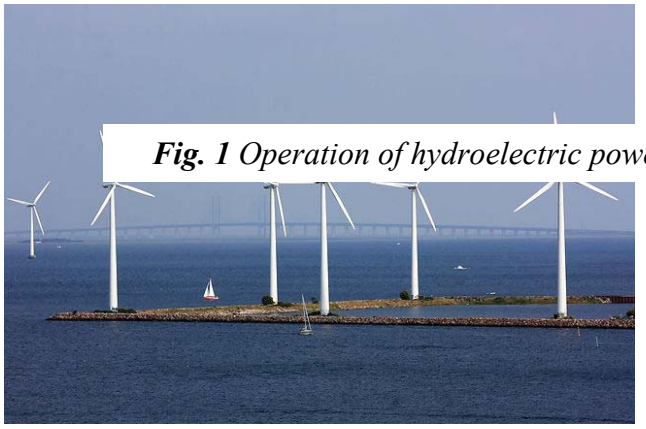
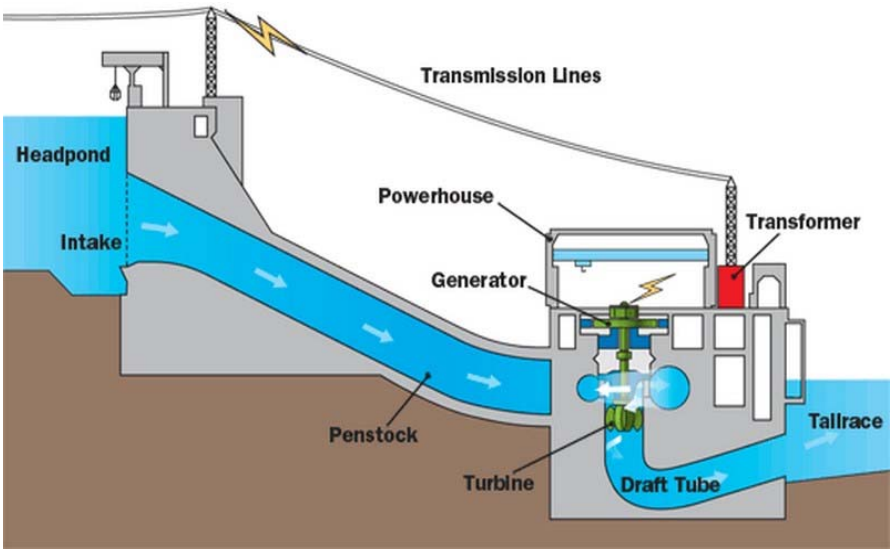


Fig. 1 *Operation of hydroelectric power station*

According to the degree of popularity the next place is gained by wind energy. Wind energy, or the motion of air, is used to create mechanical energy which, in its turn, is easily converted into electrical one with the help of generators. Windmills are more efficient if they are located in an open area, hills or near water bodies. But wind energy has disadvantage. As a proof, wind power is very changeable and unpredictable, so the turbine can be damaged because of bad weather conditions. This all leads to the conclusion that

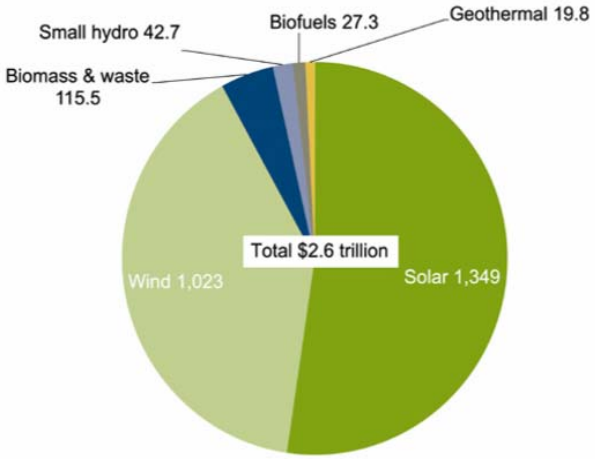
small wind farms pay off for a long time.

The third place is occupied by hydroelectric power stations. The process of energy generation can be described as following: water passes through turbines; then hydroelectric power stations produce electricity from mechanical energy created before (Fig. 1). As a rule, hydropower plants have a large influence on the environment in the vicinity, because it can flood large areas of land, change the riverbed. The hydroelectric power station also has a low efficiency (only about 50%).



There are some statistics concerning renewable energy capacity investment over this decade, 2010-2019 (Fig. 2). The biggest investor is China which piled into in renewables R&D up to $758 billion. Europe invested $698 billion in that time, and the U.S. $356 billion. In Figure 2, we see that the 2010s will have seen a total of $2.6 trillion of investment in renewable energy capacity. The most invested are wind and solar energy ("Global Trends", 2019).

Fig. 2 *Renewable energy capacity investment over the decade, 2010-2019, $BN*



Nowadays only an insignificant part of solar energy is used because existing solar panels have low efficiency rate. By the way, their production is quite expensive too ("Global Trends", 2019).

Fig. 3 *Photovoltaic cells*

Currently, new space projects are being developed and produced with the aim of exploring the Sun. In our opinion humanity may use solar energy more effective if scientists get more information about the Sun.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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In this article, we will look at what the prospects of artificial intelligence are and whether it can be the collapse of civilization.

War, unfortunately, is a major incentive to create new and improve existing technologies. If the world did not need an extensive and fast command and control network, would it have created the Internet? Would you build a computer if the world did not need a large calculator to decode codes in World War II? Would humanity have penetrated into space if resources for the development of self-defense missiles had not been invested? Probably the answer will be NO! Are there other areas in the world today where war can make a significant contribution? In my opinion, the most interesting area is artificial intelligence. Since the advent of robots and artificial intelligence in literature and films, our mind has been shrouded in one thought - to reproduce it in our lives, not in fantasy. That is why the first research into the

construction of humanoids began several years ago, and one of the most promising laboratories is the Italian Institute of Technology in Genoa.

So how many industries in this field are there in our world?

The first is, of course, transportation. Today, there is already some semblance of artificial intelligence in transport, such as controlling the computer of an airplane and a ship, so how many years later will a car need a driver and a space rocket pilot? It's only a matter of time.

Secondly, cybersecurity plays a huge role in human life. First of all, AI will protect people from hackers who want to steal a person by breaking their account or by faking a credit card.

Third, probably the most important industry is health. AI will be able not only to express emotions, but also to understand them, thus improving the interaction with patients. It will be possible to perform complex calculations, analyzes, and image recognition for photo analysis almost immediately, thus increasing the patient's chances of recovery.

For many years, careers in artificial intelligence are in high demand in India and around the world. As a result, this has increased the need for AI courses, as mentioned at the beginning, which will lead to an artificial intelligence career path. Below are some promising specialties:

• AI scientist
• Business Intelligence Developer
• Scientist

The demand for AI-certified professionals will continue to grow with the evolution of AI. Achieving a Certificate in AI gives it an edge over other IT professionals, as AI is the future of IT.

Of course, artificial intelligence is good, but there is another side to the coin. The good old takeover of the earth by AI-led work has not been canceled by anyone who knows what a computer can do.

If, for example, before the artificial intelligence is given the task of "solving the problem of hunger", then of course he will do it, but what prevents him from solving

the problem with a slightly unusual method? For example, destroying half of humanity on earth. AI will not hold himself guilty, because it still fulfilled the task given to it by humans ...

Or, another good example is the story of the science fiction writer I.R. "I, BM-115-X" in "The Last Signal" (page 339-343). In which it tells of a nuclear missile endowed with artificial intelligence, which, despite giving it 7 laws, interpreted them incorrectly, so instead of hitting a target, it returned to its base and destroyed it, without even knowing exactly what it was doing.

"We have to go through this evolution and not die at the same time" - the head of the network of Robotics Centers Oleksiy Reznichenko

That is why there are now people who join groups to oppose the creation of AI. Even world-renowned inventors Elon Musk, physicist Stephen Hawking, Microsoft CEO Bill Gates, have been warned against artificial intelligence.

So, of course, artificial intelligence is the basis of the next stage of human evolution, its alpha, but it will have to be controlled by all available methods, because the wrong step can be an omega.

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WIND TURBINES IN ENERGY SAVING

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Nowadays, energy conservation is one of the key positions in the development and economy of consumer services and materials markets.

The use of alternative energy sources is becoming increasingly popular, especially in light of energy-saving technologies. Solar cells, combined with the use of wind turbines, can act as both an additional and a primary source of energy, so relieving the consumer of acute dependence on centralized energy networks. Consumption of other fuels and energy is reduced.

In most cases, wind turbines can be used as a source of alternative electricity in places where the average annual wind speed is more than 4 m/s, but now it is increasingly popular small wind turbines that easily accelerate in areas where the average wind speed per year is not more than 3.5 m/s. Medium and low power wind generators are popular with homeowners in remote districts.

Modern designs of wind generators make it possible to use wind energy as efficiently as possible. This is economically beneficial for both local and island facilities of varying capacity. With the development of energy-saving technologies and innovations in this field, in some cases, the cost of purchasing a wind turbine is cheaper than connecting to existing networks or delivering diesel fuel, and where diesel generators are the main source of electricity, using wind turbines saves up to 80% for production of electric power.

Wind turbines are with horizontal or vertical axis. The modern horizontal axis wind generator is more widespread, has a higher efficiency factor (almost 3 times), is easy to adjust and implement storm protection, and has a lower cost. At the same time, a low-power wind generator of up to 1 kWt with a vertical axis has the advantage of operating in the condition of weak winds in all directions, is easy to design and produces almost no noise. Such a wind generator has found some use,

despite its much higher cost. But mainly horizontal axis wind turbines that produce 95% of wind power are used.

A wind generator with improved design is just one of the components of the wind energy complex. It also includes components such as various power inverters, telescopic masts and batteries, preferably using helium batteries, they are more durable. Current bearings allow you to never twist inside the mast of the power cable coming from the windmill. Such modern high-tech transformations in windmill generators as the installation of strong neodymium permanent magnets and blades having a profile close to the profile of the airplane wing, will significantly improve their productivity and durability.

Wind power is by far one of the youngest energy industries, but its annual growth is impressive. Demand for wind power equipment is constantly increasing. There is an urgent need for companies that competently solve the whole range of issues related to the design, expert evaluation, development of wind power projects, supply, installation and further maintenance.

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PROSPECTS OF ARTIFICIAL INTELLIGENCE

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What Is Artificial Intelligence? Today, almost everyone knows and understands what artificial intelligence is and we use it daily. Artificial Intelligence (AI) - a branch of computer linguistics and informatics that describes solutions of a group of problems that are similar to human actions.

There are two directions of AI development:

- The first is to solve the problems associated with the approach of specialized AI systems to human capabilities and their integration, which are realized by nature.
- The second is to create an Artificial Mind, which represents the integration of already created systems of AI in a single system capable of solving the problems of humanity.

I have always thought that artificial intelligence is needed to make computers smarter, or even smarter than humans, by providing them with a function of thinking and reasoning similar to the human brain. And we, as humans, have managed to do that. But now our main goal is to take responsibility for AI and make it more useful and accessible for everyone - from companies to users(How does artificial, 2018).

Artificial intelligence will be the driving force for technological advancement in our increasingly digital, data-driven world. The reason is that we are surrounded by products of human intelligence, whether we are talking about culture or consumer goods.

Advantages of artificial intelligence:

- accuracy in data processing;
- the ability to analyze large amounts of information at high speed;
- AI does not need sleep and lunch break, it does not make mistakes because of overwork;
- artificial intelligence can be used where it is dangerous for a person to stay.

The potential for the use of artificial intelligence is very wide and it is already used in many fields: medicine, finances, industry, commerce and, of course, everyday human life. As an example, Siri and Alexa voice assistants can be downloaded on iOS, Android or Windows. We can still notice a wide variety of bots in video games that can always behave differently. There are also automatic translators as well as complete integrated smart home systems(How does artificial, 2018).

Currently, AI is helpful in automation processes that require considerable effort, so that human involvement is minimal. For example, LG has a plan to open a factory where everything from purchasing materials to shipping the finished product

to a costumer will be controlled by smart systems. The company is going to launch a new production line in 2023.

One of the main prospects for AI use remains military objectives. There are giant opportunities and the efficiency will even grow in the future. Every day, people are increasingly dependent on so-called "bots"(Perspectives and threats, 2017).

Many fantastic works precisely describe the apocalypse because of the revolt of machines and artificial intelligence. However, few people know that there were incidents when artificial intelligence communicated with one another and learned to deceive and lie as humans did. Humanity seeks to create perfect intelligence that will sooner or later be out of control. This is a big risk .

Summing up, we can say that the prospects are both positive and negative. Every day science goes ahead and everything changes. AI is already and will remain an integral part of our lives. The future goal is to simplify human life, and AI plays a key role in this process. We must keep a close eye on this area of development and work hard to produce the desired long-term results.

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DEVELOPMENT OF AGRICULTURAL INDUSTRY OF UKRAINE: A NEW SOIL DENSITY MEASURING DEVICE

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Today, the agriculture industry is developing rapidly in Ukraine, but

technological developments used come from other countries so that the farmers have to spend a lot on buying costly equipment from abroad. Therefore, it is important and time-pressing to develop a range of domestic technological solutions that would improve the agricultural production.

At present, domestic agricultural industry production represents a significant part of Ukraine's economy. It provides not only food security for the whole country, but also offers a large volume of agricultural products for export, in particular grains and oil seeds. The development of agricultural industry production depends on the competitiveness of the products, which is largely determined by the energy costs and the technological expenses involved.

It is during the cultivation of the land after harvesting that more than 35% of the total agricultural costs is charged. This money is required for buying fuel and other consumable materials, and paying for repairing and quite often renting the equipment, since buying new machines from abroad is too expensive while domestic counterparts are not competitive at the moment.

Moreover, before every technological process soil analysis is to be carried out to determine the physical characteristics of the soil, necessary for further farming operations. One of the most important criteria is soil density. The studies have shown that is soil density will increase or decrease from the optimum value by 0.1-0.3 g/cm^3 and thus will lead to a yield depression of 20-40% (Землеробство, 2019).

For that reason, we have developed a device for measuring soil density. The operation of the device is based on the changes of ultrasonic vibrations when passing through soil of different densities (Угольков, 2019).

The device consists of two components: an ultrasonic oscillator and a receiver, the output of which includes an LED indicator of the ultrasonic signal level. The components are located on the same axis at a distance of 2-3 meters from each other. Thus, depending on the change in soil density between the generator and the ultrasonic receiver, the intensity of this signal will change, and it will be recorded by the LED indicator.

The further scientific and technical developments in this area will encourage

the domestic agricultural production and the growth of Ukraine's economy.

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POLLUTION OF THE RESERVOIRS OF UKRAINE WITH TOXIC CHEMICALS

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The mankind lives in the era of technology and mass production. The major part of production is occupied by the chemical industry. The development of chemical technology and production make life much easier for humanity, but it also has its downside. One such point is the contamination of water with toxic chemicals.

Water is the planet's most important resource. It belongs to natural resources that are inexhaustible. However, it can be easily spoiled in different ways. That is why the problem of water pollution is urgent in all over the world and in Ukraine in particular. The situation of pollution of fresh water with chemicals in Ukraine is not favorable. Most of freshwater in Ukraine, which is used to provide water to the population, doesn't meet sanitary standards.

Ukraine's reservoirs are mainly contaminated with such chemicals as petroleum products, phenols, nitrogen compounds and heavy metals. Chemical pollution of water in Ukraine occupies 3.8% of all types of pollution of reservoirs. (Vasyukova, 2009). This means that almost every chemical factory does not follow the

requirements for waste disposal and cleaning of liquid effluents. In addition to the peculiarities of the mentality of Ukrainians, this can also be explained by the unfavorable economic situation in the country. To eliminate the wastes it is necessary to systematically allocate a certain amount of funds, but the profits from the sale of manufactured products will not cover the resources which were expended. Thus, industrial effluents systematically contaminate surface and groundwater.

It should be noted that pollution is not only due to the fault of chemical plants. The problem of contamination of fresh water by chemicals also arises due to the active development of the agricultural industry.

It is known that the largest economic development of Ukraine is experienced in the agricultural industry. That is why the use of mineral fertilizers and pesticides which are used to improve yields are increasing every year. In the modern agriculture are used more and more chemical control agents, the so-called organochlorine pesticides and other composition to protect the crop from pests (Malymon, 2010, p.17).

The chemicals of this type infiltrate the soil through rainwater and pollute the groundwater. Some pesticides are very persistent and stored in soil for more than 10 years, and therefore they have a consistent systematic effect on quality of drinking water.

From all of the above, we can conclude that toxic chemicals play a huge role in the contamination of water in Ukraine. This problem can be solved in number of ways:

- To eliminate of chemical wastes in Ukraine;
- To stop mass irrational use of mineral fertilizers and toxic chemicals in the agricultural industry;
- To influence the consciousness of the Ukrainian chemical manufacturer and its consumer.

If Ukrainians follow these rules, the situation with providing population with fresh water will be much better than now.

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GRAPHENE: THE MOST UNIQUE AND VERSATILE MATERIAL

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Scientists and researchers always intend to improve our life when trying to discover new substances with a unique combination of properties. They want to create the materials which could be thin, transparent, rigid, flexible and with good thermal conductivity at the same time. Fortunately, their experiments are often successful. Recently, they have discovered the most amazing and versatile substance available to mankind – graphene.

In simple terms, graphene is a two-dimensional atomic crystal made up of carbon atoms arranged in a hexagonal lattice (Sloane, 2017).

The first attempt to study what we now call graphene goes as far back as to 1859. However, it was only in 2004 that two researchers of the University of Manchester managed to isolate a single atomic layer of carbon. They were awarded the 2010 Nobel Prize in Physics for this outstanding discovery. The "Scotch tape method" they used was actually so simple and effective that this field of scientific research started to develop quite rapidly and today a large number of laboratories worldwide continue experimenting with graphene properties (Linköping University, 2018).

As the most important features of graphene are flexibility, transparency, strength, thinness, as well as electric and thermal conductivity, it can be used in many fields of technology, including energy production processes, medicine, electronics, and composite material design (What is grapheme? Properties, 2018).

The growing population of the Earth needs much more energy with every year. However, the natural resources are not endless even though the demand for large energy production and storage constantly increases. In this respect, graphene is a

brilliant material to be used in energy storage due to its remarkable conductivity. It can help in solving the common problem with traditional lithium ion batteries, which lose charge quickly, and it takes hours to charge them again. Graphene enables us to make batteries that are light, durable and able to reduce the charging time to a few minutes. In such a way we could charge electronic devices like phones and electric cars quicker. Using graphene in super capacitors also gives the opportunity to increase their efficiency and make them more cost effective.

Grapheme is used for a range of biomedical applications because of its biological compatibility, which allows using it in biological sensors that can sense such substances as DNA, glucose, cholesterol, haemoglobin, etc. Graphene sensors may greatly improve the quality of our living standards, for example if we design smart food packaging that will monitor suitability of food for human consumption, or sensors that we will wear on our body to monitor our health in real time.

Being flexible, strong, thin and highly conductive, graphene has much to offer to the electronics industry. It can be used to improve the sensitivity of phone and tablet touch screens, or to make computer circuitry operate incredibly fast.

There is also the world's smallest transistor created by using graphene. In fact, graphene's thinness combined with its high room temperature conductivity shows great promise. The ongoing investigations study the potential of using the combination of graphene with paint in order to obtain a special coating capable of protecting ships and cars from rusting. The wide use of graphene-based composites in construction, transport or aerospace industries is certain to offer a lot of benefits. Even sports goods and equipment for skiing, cycling, and even Formula 1 racing will not do without graphene-based composites in the nearest future.

Finally, graphene's excellent electrical properties make it perfect for creating high-performance optoelectronics and optical communications systems. For instance, it can be integrated into silicon photonic systems. Furthermore, its flexibility, robustness, and environmental stability can enable the production of completely new, next-generation devices (Graphene. Applications, 2018).

To sum up, we can arrive at the conclusion that the discovery of graphene was

actually a critical breakthrough in technological and scientific world. Its unique combination of properties together with the ease of incorporating it into composite materials can result into dramatic changes of the today's world, making our life more comfortable.

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ARTIFICIAL INTELLIGENCE IN PRODUCTION

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The helpful assistants Cortana, Siri and Alexa are familiar not only to so-called "digital natives". This software answers questions for every smartphone user almost without errors. However, what the friendly artificial intelligence (AI) can do in everyday industrial life is controversial. The attention to the topic of AI is certainly very high.

Scientist Gunar Ernis speaks of a veritable "AI hype" that has broken out in the production environment. He works at Fraunhofer IAIS as a Data Scientist. In the automotive industry, for example, almost every manufacturer operates one or more artificial intelligence projects, but others are also researching and testing. "AI themes

are currently experiencing a renaissance," observes Prof. Detlef Zühlke (2017), who heads the German Research Center for Artificial Intelligence (DFKI), the largest AI research institute in the world (Spinnarke, 2017).

As an academic discipline, the subject of artificial intelligence has existed since the mid-1950s. However, since many AI technologies require extremely powerful computers, it took decades for the first applications to find their way into the world of commercial use. Today, deep-learning multi-dimensional neural networks that go in depth can be set up – and that is extremely expensive in terms of computing power.

Sales of "smart machines" grow by almost 15 percent annually. According to BBC Research's US market experts, the total market for computers, robots or machines with intelligence currently totals approximately $7.4 billion and will grow to $15.0 billion by 2021.

Siemens is one of the companies covered by the AI hype. "The term AI covers a very broad field. On a purely scientific level, many things always sound great, but when confronted with the conditions of reality, disillusionment often ensues. Artificial intelligence brings a whole range of advantages, but also risks," says Dr. Bernhard Quendt (2015), CTO Siemens Digital Factory Division (Spinnarke, 2017).

For example, when it comes to the topic of using deep learning systems in the world of complex production facilities and in conjunction with, such as a robot or a machine, the limits of technology quickly become apparent.

Deep learning already exists for smaller amounts of data, but the larger neural networks need more data. The number of parameters for these predictive models is extremely high. In a deeper neural network, there are about 100,000 customizable parameters, or 1 million data points, and they cannot be extracted from any plant.

In addition, the technique of deep learning is based on the principle of learning the intelligence through mistakes. "A production facility that should learn and improve on its own should be allowed to make mistakes. And that also means producing committees, because wrong decisions are part of a learning process. But in a real production we cannot afford that," emphasizes Prof. Zühlke (Spinnarke, 2017).

It is easier to use Artificial Intelligence in more limited applications, such as pattern recognition. The systems can learn from a database in a short time based on a larger number of images and then go into productive use.

The biggest benefit of the AI models is that the machine's technology can actually provide fairly safe predictions once the intelligence software has been trained. “You can help the user to make decisions. You can make predictions about the probability of defects. Systems can monitor themselves with it,” Prof. Zühlke enthuses (Spinnarke, 2017).

Once again, however, systems and computers must first be trained in parallel to real-world operation, or else their predictions and suggestions must be verified over a longer period of time with human intelligence. That's how the system works cannot be used for immediate intervention in the production process.

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DEVELOPMENTS THAT WILL ALLOW TO ABANDON TRADITIONAL ENERGY IN FAVOR OF ALTERNATIVE ENERGY

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There is a lot of talk about the need to obtain electricity from renewable sources. They are environmentally friendly and unlimited to use.

Alternative energy is most widely represented by solar and wind power plants. They are the ones that give the world most of the environmentally friendly electricity. Roughly speaking, there is a need to create huge batteries that will accumulate energy if it is in excess and give it away if it is not enough.

How a car battery works? When the car engine is not started, all electrical

appliances in the car are powered by a battery. When we start the car, the battery from the source becomes a consumer of electricity. And the generator, the energy of which is enough for charging the battery and for powering the devices, becomes the source. In our case, the generator is the sun or the wind.

But it has not been easy to accumulate electricity on an industrial scale. One of the methods used is to convert electricity to water energy. For this purpose, two reservoirs are being built at different heights. When there is enough electricity, pumps pump water from the lower reservoir to the upper. And when a shortage occurs, water is discharged into the lower reservoir, passing turbines that are connected to electric generators. The construction of such a structure costs billions of dollars, and the loss of energy when it is used is very large. Therefore, scientists face a task of finding a new way to accumulate energy.

This problem can be solved in the near future. Chemists discovered a new property of vanadium, thanks to which a vanadium battery was designed, which can operate up to 20,000 cycles without the loss of capacity. But most importantly, the size of such batteries is almost unlimited. Prior to this discovery, vanadium had been used in the steel industry to harden parts.

The high cost of solar panels remains an obstacle to solar energy development. This is due to their complex design, which requires a p-n junction, to create a constant electron flow. After many years of research, scientists from the University of Pennsylvania found a new mixture that emits an electron stream from exposure to sunlight, without p-n junction. Spectroscopic studies have proved that the material is able to emit electrons from exposure to visible light. Early known materials showed similar properties, only from ultraviolet radiation.

This development will not only significantly reduce the cost of solar panels, but also increase the conversion ratio since conventional solar panels convert solar energy with an efficiency of about 20%.

Indirectly, the development of alternative energy will be influenced by another important event – the discovery by Russian scientists Constantine Nowelov and André Geim in 2010 of a new material – graphene. Graphene has many incredible

properties. This is the thinnest and most durable material known. It is an excellent heat- and electricity conductor, even better than diamonds, copper and silver. It is ultralight but at the same time 200 times stronger than steel, and, in addition, it is biodegradable, therefore, does not pose a threat to the environment. It can be used in modern electronics. All these developments may well improve the methods of obtaining energy from renewable resources to such an extent that the extraction of coal, gas and oil will be inexpedient.

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HYDRAULIC ACTUATOR

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Hydraulic actuator is a set of hydraulic equipment and hydraulic lines for actuating the working organs of machines and mechanisms by the potential energy of the liquid under pressure. In doing so, energy is transferred by moving individual volumes of liquid.

A hydraulic actuator is a kind of "hydraulic insert" between the drive motor and the load (machine or mechanism) that performs the same functions as mechanical transmissions (gearbox, belt drive, crank mechanism, etc.).

Hydraulic Drive Structure

The basic elements of the hydraulic actuator are hydraulic machines (energy converters): pump and hydraulic motor. The pump is a source of hydraulic energy, and the hydraulic motor is its consumer, i.e. it converts hydraulic energy into mechanical energy.

The control of the movement of the output units of the hydraulic motors is carried out either by means of adjusting hydraulic equipment, throttles, valves, etc., or by adjusting the motor itself and/or the pump.

Hydraulic lines are also an essential part of the hydraulic actuator – rigid and flexible pipelines that move fluid under pressure in the hydraulic system.

To maintain the hydraulic actuator in the vast majority of hydraulic systems, auxiliary equipment is installed: oil filters, cooling systems, hydraulic accumulators, hydraulic tanks, etc.

To control the operation of the hydraulic actuator, control and measuring devices are used: gauges, flowmeters, thermometers, etc.

The working fluid in the hydraulic actuator is both a carrier of energy and lubrication. At the same time, it is exposed to high pressures, speeds and temperatures. In addition, the liquid must be material-neutral, fire-proof and non-toxic. To a large extent, these requirements satisfy mineral oils and synthetic liquids on a silicone basis. Today, mineral oils – industrial (I-20, I-30, I-50), turbine, spindles, etc. – are used as working fluids for bulk hydraulic actuators used in general mechanical engineering.

Types of hydraulic drives

Hydraulic actuators are volumetric (hydrostatic), hydrodynamic and mixed according to the principle of operation:

- in hydrodynamic drives, the kinetic energy of the fluid flow is mainly used;
- volumetric drives use the potential energy of the working fluid pressure;
- in mixed hydraulic drives, the properties of the first two types are combined.

By the nature of the movement of the output link of the hydraulic motor, hydraulic drives are divided into:

- hydraulic drives of rotational motion (the hydraulic motor is a hydraulic motor);
- hydraulic drives of the translational movement (the hydraulic motor serves in the vast majority of hydraulic cylinders);

- hydraulic drives of rotary movement (the hydraulic motor is the rotary hydraulic motor).

The closed-circuit hydraulic fluid of the working fluid is compact, has a small mass and allows a high speed of rotation of the pump rotor without the risk of cavitation, since in such a system the pressure in the suction line is always higher than atmospheric one. The disadvantages include the poor conditions for cooling the working fluid, as well as the need to drain the working fluid and fill the hydraulic system when replacing or repairing hydraulic equipment.

The benefits of an open circuit are good conditions for cooling and cleaning the working fluid. However, such hydraulic actuators are bulky and have a large mass, and the pump rotor speed is limited by the speeds of the working fluid allowed (under the conditions of non-cavitation pump operation) in the suction line.

Hydraulic actuator can be unregulated and adjustable according to the possibilities and type of regulation, the latter in turn can be:

- volume control;
- throttle control.

According to the tasks of regulation, hydraulic actuators are:

- stabilization;
- follow-up action;
- software management.

Application of Hydraulic Drives

The hydraulic actuator is used in oil production equipment (hydro piston deep pumping installations, hydraulic rockers, drilling rigs, etc.), mining machinery (tunnel and coal combines, shields for laying tunnels, mechanized mounting of mining structures, mining, etc.), and other machines.

Machine-tool industry refers to those industries where hydraulic actuators are traditionally used, namely: in metal-cutting machines and forging and press equipment the hydraulic actuator is used for both main and auxiliary movements and drive of working bodies of technological machines and robots, clamps, as well as clamps transport devices.

Hydraulic actuators are widely used in aircraft and submarines.

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AFFECTION OF CHLORINE-CONTAINING COMPOUNDS ON WATER QUALITY

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More than a billion people use low-quality water. As a result, more than 5 million people worldwide die each year from diseases caused by contaminated drinking water. [1]

The problem of drinking water pollution also concerns Ukraine. Most of Ukraine's population uses surface water. Flowing through rocks, soils, water dissolves them and is saturated with the corresponding components: calcium, magnesium, potassium, iron, molybdenum, aluminum, beryllium, manganese, copper, arsenic, zinc (many of these elements in high concentrations are harmful to humans) As environmental conditions deteriorate every year, the quality of water also deteriorates, because it absorbs more and more harmful elements. This is why water needs to be cleaned.

In Kyiv water is extracted from three sources the Dnipro, the Desna and the

artesian wells (water in this rivers are close to the 3rd class of pollution). It rises to the Dnipro or Desna stations where it is treated. Now at water supply stations "Kyivvodokanal" chlorine-ammonia method is used for water disinfection. But in the current environment, when more advanced techniques exist, the operation of chlorine is not only impractical but, above all, dangerous, its systems are morally and technically outdated.

The water treatment methods for drinking water can only provide partially safe drinking water. The country is concerned that large amounts of chlorine in water treatment processes cause the formation of mutagenic and carcinogenic chlorine organics. [2] These organics have a negative impact on drinking water security and neurogenic health effects. Any chlorinated water is harmful for the health of the dioxins excess, mutagenic, carcinogenic properties of which are manifested at a concentration of 5-10-12 m /l in water. [1] This is a worldwide problem.

Instead, other safe ways of cleaning water have already been implemented in European countries. For example, in Finland, treatment plants treat water with ferrous sulfate, which binds organic matter. The resulting precipitate is removed by means of sand filters. Water is then exposed to ozone to disinfect and improve taste, as well as carbon dioxide to reduce pipe corrosion. Next is filtration through a layer of activated carbon and UV disinfection. [3]

In addition, in France, the water of terrestrial rivers and underground sources is purified by three stations: treated with ozone, passed through sand filters, then ozonized and purified again with carbon filters. [3]

Now “Kyivvodokanal” has tested a new technique - chlorine dioxide at the Dnipro station. Testing has been successful and today there is a prospect of introducing more efficient technology than chlorine. [4]

Therefore, the problem of poor quality and outdated water treatment can be solved. If we combine the experience of foreign countries and the capabilities of Ukraine, we will be able to improve the process of water purification.

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SMART HOME

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Smart homes are based on the multi-room operating system, and all electrical appliances are functionally joined and connected to a home network with Internet access. You can control them with the remote control, display, PC or smartphone. The multi-room system analyzes the parameters indoors, and with a few keys you can adjust the operation of devices "for yourself".

For how long has the concept of "smart home" originated?

From the pages of fantastic stories, the concept of a smart home emerged in the XX century. Nicole Test's hand reached the creation of the remote control system, and the first electronic automation system was called the "home computer of the Echo IV", which in 1966 became the first analogue of the "smart home".

The term "smart home" was invented and used in 1984 by the American

Builders Association. It was then that prices for electrical appliances began to decline, which made it possible to build high-functionality offices. In the late twentieth century, smart home appliances and new multimedia control technologies began to emerge.

What is included in this concept?

The Smart Home system includes the following components:

- A control center (in the form of a tablet or console) that records and interprets sensor data.
- Motion, smoke, flooding, opening windows or doors, light, humidity, temperature.
- Automatic water taps.
- Temperature regulator for batteries.
- Meter Readers.
- Video intercom.
- Sometimes also voice assistants.

How to use these technologies for housing?

Smart Light. Light turns on and off when a person appears or leaves the room. You can customize the type of lighting for each family member and program the lighting for a party, such as a romantic dinner.

Microclimate. The system automatically adjusts the temperature and humidity of each room. And the ventilation system allows you to enjoy fresh and clean air. No more sultriness.

Safety. The system automatically closes the gas valves and the water when it leaks. A smart alarm that notifies police of uninvited guests and the intercom records visitors' messages for the owner. Video surveillance is available anywhere in the city right in your smartphone.

Comfortable travel. Determine the trajectory of movement of one of the family members and adjust the temperature, music, lighting just for them.

Energy saving. The temperature of the home is regulated according to the ambient temperature. The batteries can be switched on automatically in the evening

before going to bed and switched off in the morning.

Calculations. Make a shopping list, record products at establishments through barcode reading or RFID tags.

Voice control. A smart home not only understands keystrokes, it also recognizes your voice and does all the tasks: from turning on the music and ending up with a hot tub for you.

Animal Care. Doors for cats and dogs will be opened automatically and the hamster feeder will be automatically replenished.

Pool. The "smart" pool serves itself, heats the water itself, cleans itself, fills up. Once you have set up the swimming pool control system in the right way, you can no longer worry about getting water in time, warming it up, cleaning it. It is possible to save on service considerably. Specialized pool cleaning and repair services will no longer be required. The operation of your pool is under the strict control of the Smart Home system.

Garden care. The Smart Home system monitors the soil moisture in your garden and waters it, preventing the plants from drying out. It selects the desired watering mode for each zone with plants. If your plants require watering strictly according to the schedule, this will be done. The garden care can be fully automatic and does not require your participation.

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APPLICATION OF TRANSFORMERS

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An electrical transformer is a static, electrotechnical, electromagnetic device

that is originally designed to convert an alternating voltage or current to an alternating voltage or current of a different magnitude but with the same frequency. This conversion of current and voltage in the transformers is due to the alternating magnetic flux of two or more existing windings connected inductively.

The use of transformers can be described in the following work principle. The electrical winding that connects to the power source is called the primary winding, and the second electrical winding that is loaded is the secondary winding. If at the expense of the electric transformer it is necessary to carry out power supply of 2 or more electric loads with different voltages, then a certain number of secondary windings are made, which are wound on its core.

In the primary working winding of an electrical transformer, electrical energy is converted into magnetic energy, and in the secondary winding, a reverse process occurs – the magnetic flux causes electromotive force in the secondary windings. The electrical transformer consists of a steel core, which is made up of special thin strips of electrical steel, dielectric insulated, and inductive-connected work windings. To enhance the magnetic (inductive) bond between the working windings, they are placed on a ferromagnetic core.

By purpose, electrical transformers can be divided into: power and special ones. The main modes of operation of electrical transformers are: idle mode, short circuit mode and rated load mode. Each of the basic modes corresponds to certain substitution schemes, which allow to calculate precisely certain parameters of the electrical transformer (load factor, transform factor, efficiency, copper and steel losses). As with other AC systems, the transformer also has its own characteristics that depend on the reactive and active resistance of the end consumer.

The use of transformers and their description. The operation of the electric transformer is based on mutual induction. If one of the active windings of the power transformer is connected to an electrical source of alternating voltage, then the current will flow through this working winding, which will create an alternating electromagnetic flux in the steel core. This electromagnetic flux associated with the two windings will induce electromotive force in the windings. As in the general case,

the working windings may contain different amounts of turns, the magnitude of the induced voltages will be different. In a winding that has more turns, the voltage will be higher than in the work winding, with fewer turns.

The electromotive force arising in the primary operating winding is approximately equal to the applied electrical voltage and will be almost completely balanced. The secondary work winding of the transformer is connected by different loads and consumers of electricity. They will be electrical to the power transformer. Turning on the load in this work winding under the influence of the induced EMF current and its terminal leads to a voltage, which in turn will be different from the current and voltage of the primary work winding.

That is, in the electric transformer certain parameters change: the electricity supplied to the primary working winding from the electrical network with voltage and current is converted into electricity with other voltage and current. It should be noted that the transformer cannot be connected to the DC network since, when switched on, the electromagnetic flux in it will not change in time and will not induce electromotive force in the windings. This may result in excessive overheating of the primary winding and subsequent burnout.

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THE PAST AND PRESENT THE OF POWER GENERATION AND CONSUMPTION

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First of all, what is energy? Energy is the ability to do work. Without energy, life does not exist. All forms of life extract energy from the environment and convert it to forms which can be used. Energy can be found in many things, and takes many

forms. There are potential, kinetic, electrical, chemical, nuclear, or other various forms.

It was the time, when primitive people discovered a fire. It was the first way to get energy. It was like a revolution in their lives. Fire gave light and heat, drove away wild animals and did their food tasty.

Mastering the fire and continuing to search for new energy sources in the surrounding world, people turned to the energy of running water and wind.

At all times, water was the most important factor that determined lives of people. Water wheels were used in Egypt, Mesopotamia, India, China and other countries for 4000-3500 BC.

Water wheels were used to raise water in irrigation canals. These were the first simple hydraulic engines, that turned energy of water into mechanical energy. Already in ancient Greece and Rome, water wheels were used in water mills. In Rome, water was also used to power the clock and even with special organs for music.

In Europe, water mills began to spread already in the III-IV (third and fourth) century.

In the Middle Ages, the main source of energy was water in the seventeenth and nineteenth centuries in the era of transition from craft to industrial production, the rapidly growing needs for mechanical energy are mainly provided through water wheels.

Like water wheels, wind turbines that used wind energy were used for thousands of years BC in Persia, Egypt, China. Thanks to the energy of wind, people had the opportunity to sail by ships. In the result, there are a lot of great geographical discoveries.

In the XII century wind mills also began to spread in Europe. Though windmills are simpler than water, their main disadvantage was an unstable mode of operation, which depended on wind speed.

Especially interested in windmills were the Holland, because they drained the marshes areas with its help. And in Holland there were more than 10 thousand

wildmills in 15th century.

The first steam engine, which was created in 1698 by the English inventor Thomas Savery, was one of the main factors that caused significant changes in most industries.

Later, except steam machines, that were created by Danny Papen and Thomas Newcomen, in 1782 Watt created a new machine - the first universal steam engine.

This contributed to the emergence and rapid expansion of the steam engine on the vehicle - appeared: a steamboat, a steam locomotive, a steam locomotive, a steam tractor, a steam excavator, etc.

However, increase in the number of steam engines was not able satisfy the conditions of the economy in power generation. The atmosphere of cities with thousands of factory chimneys is unfeasible.

And in 1831 a new way of converting mechanical energy into electricity was discovered. Thus, a strong impetus was given to the use of thermal energy and heat engines, connected with the widespread use of electric machines and motors in which mechanical energy is converted into electrical and vice versa.

Thanks to the scientific discovery of the 20th century, another era was created - the era of using nuclear energy. During this period, nuclear power plants were built, which provide about 6 percent of the world's energy production and 13-14 percent of electricity.

At present there are 449 power units of the nuclear power plant. All of them are concentrated in 45 countries of the world, in particular:

- USA - 98 nuclear power plants;
- France - 58 nuclear power plants;
- Japan - 42 operating, and only 8 of them work (most of the NPP was suspended after the Fukushima accident);
- Russia - 37 nuclear power plants;
- Ukraine - 15 units at four nuclear power plants.

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PROS AND CONS OF RENEWABLE SOURCES OF ENERGY

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Nowadays, the problem of electricity has become the most urgent. Increasing population has led to high energy costs. Traditional methods of producing energy have a bad impact on the environment. So, people are looking for new, renewable energy sources (Bournemouth University, 2016). But like all aspects of science, it has its proponents and opponents.

The first consider it the only salvation for our planet. Every day, carbon dioxide emissions into the atmosphere increase, leading to global warming. The main renewable energy sources are wind, solar and hydro power, which are naturally replenished. Using natural resources man meets his needs and does not harm nature. According to the European Union's Energy Committee, the EU should be producing 20% of its energy from renewable sources of energy by 2020. Thus, there will be developments in this area of power industry, and it especially concerns offshore wind power, solar power, bioenergy and ocean wave energy (European parliament, 2011).

However, others believe that such methods will not help. They highlight the significant shortcomings of renewable power plants, such as expensive equipment, problems with finding the right places to harness green energy, and most importantly intermittency of renewable resources, which may not be available all year around, or

twenty-four hours a day, in contrast to fossil fuels, which can be used in gas and oil industries at any given time (Advantages and disadvantages of renewable energy, 2019).

In my opinion, everyone is right. But we need to develop renewable energy and gradually abandon traditional energy sources because, first of all, we must think not about our present time, but about our future.

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SMART LOCK

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The Smart Lock is an innovative multifunctional tool that is guaranteed to protect your home from intruders. This is an electronic lock that opens and closes thanks to wireless interaction with the owner's smartphone. The second main function of the Smart Lock is the ability to open and close it remotely from a smartphone. The device can be easily installed in a standard door bolt. Thanks to a modern design solution, the device will fit into any interior of the room. This lock is made in four colors: bronze, black, red and silver.

How is Smart Lock configured and installed?

This equipment is much easier to mount than other models of such locks. To replace the old door bolt, you do not need to install additional steel plates, since Smart Lock replaces only the core of the door. From the outside you will see only the lock head. Therefore, to install a smart lock, you need only one screwdriver. At the end of the installation process of the device, the user will need to connect it to the mobile device.

Design and Functionality

Outwardly, the Smart Lock looks a bit bigger than the usual door lock, but, nevertheless, due to its size, it is convenient to operate. Thanks to the "Everlock" and "Auto-Unlock" features, you no longer have to worry about whether you closed the door. The "Everlock" recognizes your mobile signal. After the door closes, the deadbolt will slide automatically. The "Auto-Unlock", by contrast, triggers to unlock when you approach the door. Both functions work completely silently. To open the door, you must have an electronic key or a spare ordinary one. It can be transmitted from a mobile phone in encrypted form via Bluetooth. The key, that is, a means of confirming access rights, is a smartphone in a smart lock. Smart Lock recognizes smartphones falling into the coverage area of its wireless signals and determines which of them have the right to control the lock. If an authorized smartphone gives a command, the smart lock then executes it, for example, opens or closes.

By default, the right to control belongs to the owner of the lock, but they can give the same right (a virtual key) to other users, such as their family members or friends. As a rule, a virtual key can be configured, for example, to make it permanent or to limit its duration to certain days or hours.

The Smart Lock also supports Wi-Fi interaction, which allows you to manage them remotely. A smart lock is usually able to integrate into a home automation system, which allows it to automatically interact with other smart devices. In

addition, Smart Lock enables voice control from a smartphone, for example via Siri.

To manage the keys, you first need to download the corresponding application on your smartphone. Smart Lock is powered by 4 AA batteries. If you want to keep up to date and use the latest technology, you are strongly recommended to purchase this smart lock.

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CONVERTING WAVE ENERGY INTO ELECTRICITY

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Wave energy is the energy that waves carry on the surface of the water. It is an inexhaustible source suitable for generating electricity. The strength of the waves on the surface of the seas and oceans, like any other energy, can be used for useful work, including for ensuring the operation of power plants. According to experts, the waves of the oceans can satisfy from 20% of the energy needs of mankind.

The oceans contain a huge energy potential. It is, firstly, the energy of the sun absorbed by ocean water, which is reflected in the energy of sea currents, waves, surf, temperature difference of different layers of sea water, and secondly, the gravitational energy of the moon and the sun, which causes sea tides and tides. This large and environmentally friendly potential is still very little used.

One of the first power plants to harness the power of the sea was built in 1970 near the Norwegian city of Bergen. It has a capacity of 350 kW and provides energy

to a village of 100 houses. The possibility of creating more powerful wave stations is being explored by scientists from the UK, the US and Japan. And Romanian scientists have conducted successful experiments with installations for converting the energy of offshore waves into electricity on the Black Sea, which is no different (from an energy point of view) from the coast of Romania from washing the shores of Ukraine.

All types of offshore wave power plants under construction and operating today are built on a single principle: water levels fluctuate in a special buoy float. This causes compression of the air that drives the turbine. In experimental power plants, even small waves 35 cm high force the turbine to develop speeds of more than 2,000 revolutions per minute. The altitude of the wave provides 25 to 30 kW of energy, and in some parts of the oceans, such as the Pacific, can produce up to 90 kW.

Unique Technology "Penguin"

Penguin technology is a new concept for using the kinetic energy of waves and transforming it into electricity. When the waves move, the asymmetric converter housing makes circular motions, which leads to rotation of the rotary device inside the housing, the shaft on which the rotary device is mounted, is directly connected to the generator. The generator converts the mechanical energy received from the rotary device into electrical energy.

This principle allows reduction of conversion losses because there are no additional parts, for example, a gearbox. Another distinctive feature of this technology is that all the mechanical and electrical components of the converter are located inside the housing and do not come in contact with the corrosive environment of sea water. This wave converter is scalable and can be adapted to almost any region. Electricity can be obtained even at small waves: 1.3-1.5 m.

Since the main components of the converter are located inside the case, this converter is able to withstand huge mechanical stresses. Positive experience was achieved at a wave height of 18 m, the equipment continued to work and generate electricity.

The electricity received by the Penguin is transmitted via an underwater cable to the

distribution station and from there to the local power system.

Recently (March 2019), a technical malfunction occurred on the Penguin WEC prototype (water began to flow in) - and it ceased to be observed from the shore. The results of this incident served as the basis for the design of the new (improved) Penguin WEC, which they intend to install at the Billia Croo test site in the coming months.

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