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ЭЛЕКТРОННЫЙ СБОРНИК МАТЕРИАЛОВ МЕЖДУНАРОДНОЙ КОНФЕРЕНЦИИ СТУДЕНТОВ, АСПИРАНТОВ И МОЛОДЫХ УЧЁНЫХ **«ПРОСПЕКТ СВОБОДНЫЙ-2016»**, ПОСВЯЩЁННОЙ ГОДУ ОБРАЗОВАНИЯ В СОДРУЖЕСТВЕ НЕЗАВИСИМЫХ ГОСУДАРСТВ

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TOWED ARTILLERY PROSPECTS AND METHODS OF DEVELOPMENT

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Today, part of the cannon artillery ground forces of foreign states includes towed and self-propelled guns, which are called "howitzers", since their main purpose is to conduct mounted shooting with remote closed positions. A large part of modern howitzer able to fire and direct fire at a distance of up to 2 kilometers. It is this feature of them, howitzers in some way change their purpose, as defined in Russian classification for the concept of "howitzer" in the division artillery guns and howitzers on. The first correction in terminology due to the development of artillery, created based on the ability to quickly change the combat situation. In the context of the transience of modern battle field artillery must comply with the ability to deploy and level of mobility it supports units. At the same time their main task of providing fire support artillery units can be solved only at a sufficiently high accuracy of fire and a little time spent in preparation for the opening of fire and collapse firing positions after the decision of tasks in order to avoid the counter-battery fire of the enemy. On the one hand these requirements fully in line with self-propelled artillery (ACS), which theoretically has the advantage over the towed guns. But at the same time have a number of disadvantages ACS. For example, they have a much greater mass. In favor of conventional towed howitzer is the fact that since the early 1980s, most of them equipped with auxiliary thrusters that allow to move on the battlefield gun for short distances without the use of tractors.

Currently, the total volume of Russian state tests have been towed 125-mm gun with self-movement PTP 2A45M "Octopus-B" and lightweight 152 mm howitzer 2A61 "Pat-B". These samples are mounted on carriages howitzer type D-30A allowing the circular firing. This is mounted on the carriage mechanism shall be sent shells, which provides howitzer rate of 8 rounds per minute. On the upper machine howitzers to protect calculation set light shield cover. In this 152-mm howitzer "Pat-B" with a mass of 4350 kg. according to the might exceed 122 mm howitzer D-30A twice. The whole procedure of transfer of the howitzer from traveling to combat and back takes less than 2 minutes. In addition, 152-mm guided munitions "Krasnopol" can be used with this howitzer. Recent advances in production techniques stems 52-gauge length can fire at a distance of 40 km. This allows the range artillery batteries equipped firing positions considerably further from the front line, which reduces the risk of the enemy, and the need for protection of armored gun crew.

Many foreign experts, analyzing the ACS and towed artillery, in favor of the second include not only the combat capabilities of howitzers, and lower cash costs for military equipment and weapons, the maintenance personnel. If guided by saving money, it can be concluded that the 3 batteries of towed howitzers, which are equipped with conscripts, cost a little more expensive battery ACS 1, manned by contract servicemen. If we evaluate the howitzer on the criterion of "cost / effectiveness", it may be noted that for the developed countries with a stable economy is preferable to be armed with self-propelled howitzers. This towed howitzers and self-propelled guns have the same firing range. At the same time Division 3 towed howitzers (BG) are able to be much more efficient (compared to 1 division ACS) due to the numerical superiority, as well as a greater number of shots fired. Saving survivability towed howitzers also increased, as the 2-3 BG division are more difficult goal. And the possibility of independent movement tools (due to the presence of the auxiliary propulsion) at distances up to 500 meters significantly increases the chances of survival. And

also, towed artillery difficult to detect with ground-based electronic intelligence. These towed artillery still has some superiority over the self-propelled.

Currently, experts believe that the perfect cannon must have a mass comparable to the 105-mm guns, and firing range and firepower to the 155-mm artillery shells at. Recent advances in the field of metallurgy will help to make this a reality. Today, the lack of range of fire of the light howitzers of 105 mm (20 km) limits the possibilities for their use in combat. This flaw is due to the size of artillery shells and the difference in volume. caliber shells Height from 105 to 155 mm in a position to increase the capacity of the munition charge once 4 times. Today, most countries undergoing modernization developed heavy 155-mm towed howitzers, which can not be transported on external sling helicopters. The main efforts of designers focused on the increase in the range and increase the accuracy of fire, the achievement of partial autonomy (as in Russia, "Pat-B"), and reducing the time to prepare for the shooting. So in South Korea in the process of modernization of the American 155 mm howitzer M114A1 howitzer was created KN179. As a result of this work the maximum firing range high-explosive ammunition could increase to 22, 000 meters, and the active-reactive ammunition - up to 30, 000 meters. At the same time, experts note, the active-reactive ammunition are not used for the shooting of this howitzer. Increase the range of fire managed through the use of a new barrel length 39 calibres.

The Swedish company "Bofors" to reduce the load on the calculation of the heavy 155 mm howitzer FH-77B with a barrel length of 39 caliber created a special crane for lifting shells. This crane is mounted on the right side of the breech of the howitzer. In addition, FH-77B is different in that it is carried out fire without lifting wheels. In order to achieve an even greater range of fire today artillery barrel length of 45 caliber and 52 have been developed. However, it should take into account the fact that as the length of the barrel increases growth and weight howitzers. Currently, the most severe of the 155 mm howitzer is a South African G5 Mk3 with a barrel length of 45 caliber. The weight of the howitzer is about 14 tons, and the range of fire of active-reactive ammunition comes to 39 km. Flitches This allows you to mount a howitzer barrel length 39 and 52 gauges. As a South African design, howitzer of GH (Finland), the TIG 2000 (Israel) and GH N (Austria, Belgium, Canada), if necessary, can be equipped with barrels of different lengths. At the same time the growth of mass oscillating parts has led to an increase in the load on the gun crew for a transfer from traveling to combat and back and firing. To facilitate the maintenance of modern heavy howitzers with a barrel length of 45 caliber and 52 are equipped with an auxiliary propulsion that drives the loading mechanism drives and howitzers guidance. In addition, the mover can move howitzer for a limited distance at an average speed of traffic on the highway - 15-18 km / h, on rugged terrain - 8-10 km / h. A number of samples, such as GH N-45, produced without auxiliary propulsion. Equipment towed howitzers auxiliary engine ensures their partial autonomy. This is becoming increasingly important development of automatic fire control systems. For example, the company "DENEL" from South Africa develops on the basis of JMA ring laser gyroscope for 155 mm howitzers G5 Mk3. African MSA allows you to perform the first shot after 2.5 minutes after arrival at the position. In this case the barrel pointing accuracy is 1 division protractor.

To date, it can be concluded that the traces 2nd major trends in the development of towed howitzers and artillery pieces: the first concerns the reduction of the mass of guns, the second - improving the accuracy of fire. howitzers weight has a direct impact on the possibility of their transportation. Also in the field of design and development experts are paying significant attention to economic issues. By reducing the weight of shells falling transportation costs 1 instruments. If we talk about improving the accuracy of fire, it is one of the prerequisites of modern military development. This criterion is very important for a quick strike and timely removal units. The higher accuracy of fire, the less expensive ammunition

needed to hit a target. Reducing the use of weapons leads to cost savings and reduces the load on the force logistics and increases the operational units. Possibility to apply accurate artillery strikes especially needed during operations at a substantial distance from the main forces of the Army.

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THE USE OF BIOENGINEERING IN MODERN MEDICINE

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Bioengineering is a relatively new discipline that combines engineering principles used in biology and medicine. Scientists in this field are able to recreate almost any part of the human body, print it on the 3D-printer, which will help save a lot of people in need of organ transplants.

We face many major health problems such as ageing and multiple injuries that lead to the disability and death. According to Kursk State Medical University there are currently 100000 people waiting for life-saving organ transplants in, whereas there are only 1,000 organs available for transplantation. Most people do not want to be donors, so there is a large gap between the numbers of registered donors compared to those awaiting organ donations on a global level. According to statistics there are 40 donors per million people in Spain, 22 donors per million people in the USA, and only 2.9 donors per million people in Russia. Therefore, replacement with artificial organs is one of the possible solutions to this problem.

So far, this method has been developed and tested, and its potential is great, because it allows scientist to grow organs directly from the patient's own cells, it reduces the risk of tissue and transplant's rejection. Laboratory-grown organs are at the frontier of medicine, with scientists experimenting with growing bone, cartilage, even more complex organs like kidneys and hearts. In labs around the world, bioengineers have begun to print prototype body parts: heart valves, ears, artificial bone, joints, menisci, vascular tubes, and skin grafts. Anthony Atala and the group of scientists from the institute of regenerative medicine at Wake Forest have succeeded in this area. They have created a system of integrated print tissues and organs (IOPT). They basically have recreated capillaries, creating microchannels that acted like a capillary bed Biodegradable plastic-like materials are used to form the tissue shape, and a water-based gel delivers the cells to the structure. A temporary outer structure helps to maintain the object's shape during the printing process. To address the size limit, the researchers have embedded microchannels into the design that allow nutrients and oxygen to be transported to cells anywhere within the structure.

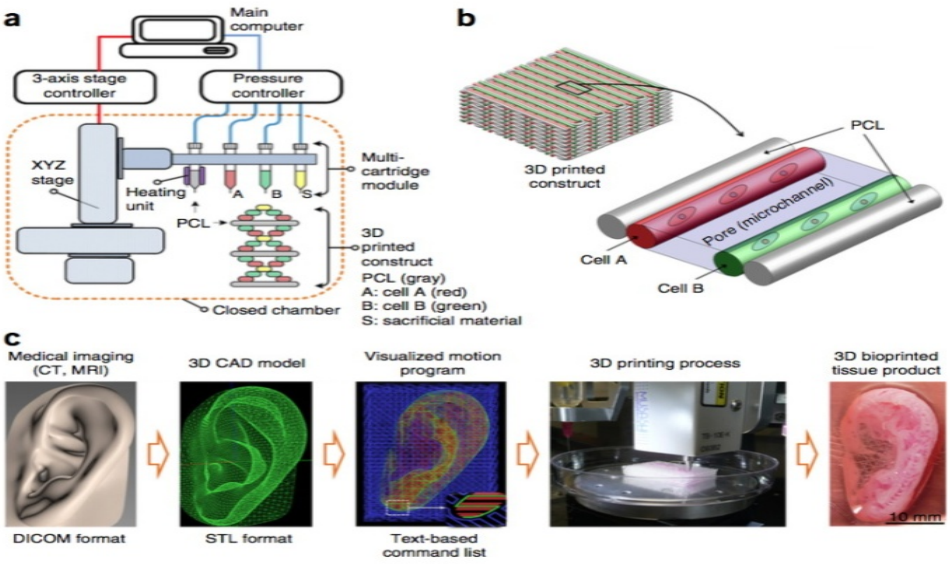

Fig. 1 -Printing process

Prostheticis thereplacement for lost or damaged limbs which allows a person to remain physically active.Nowadaysbecause of constant development in the field of mind-controlled prosthetics, the prosthesis is not just a senseless thing, which is difficult to manage. For example, Igor Spetik has lost his arm in an accident at work. He had suffered from a phantom limp painsince his injury. Sometime later, he received a prosthesis which was able to restore sensation. Surgeons Michael Keith and J. Robert Anderson, both from Case Western Reserve School of Medicine and Cleveland VA, had implanted tiny electrode-laden cuffs around nerve bundles within Spetic's arm. Insulated wires run from the cuffs inside Spetic's forearm up and out of his upper arm. Hooked up to sensors, Spetic can feel 19 distinct locations in his fingertips, palm and the back of his hand. Electric pulses sent through the wires feed signals to Spetic's brain. It's as though his prosthetic hand actually “feels” touch.

According to Case Western Reserve University electronic journal, Össur, company dealswith thedeveloping of bionic prosthetics,has announced the successful creation of bionic prosthetic legs that are managed by the human brain [2]. The new technology uses special implantable sensors which send wireless signals to the built-in microcomputer in artificial limb. People can control the prosthesis on a subconscious levelthat gives fast and natural response on a movement.These computerized “smart artificial limbs” are capable of real-time decision making of the need different action to provide human comfort, speed and efficiency of use for whatever surface.

In the near future, people will be able to replace their organs and parts of body with prostheses grown from stem cells.Stem cell is undifferentiated cell of a multicellularorganism which is capable of giving rise toindefinitely more cells of the same type, and from which certain other kinds of cell arise by differentiation. Stem cells renew and replace lost or damaged cells. Theoretically, any organ can be grown from stem cells, for this reason stem cell research is a field that has attracted considerable scientific and financial investment and attention in many countries. For example, Japanese scientists have managed to grow structurally complete capillary blood vessels, scientists in the United States have grown full-fledged brain cells. According to Rene Anand, the brain organoid, engineered from adult human skin cells, is the most complete human brain model yet developed. The lab-grown brain, about the size of a pencil eraser, has an identifiable structure and contains 99 percent of the genes present in the human fetal brain. Such a system will enable ethical and more rapid and accurate testing of experimental drugs before the clinical trial stage and advance studies of genetic and environmental causes of central nervous system disorders. Moreover, the prototype of an artificial uterus was successfully created on the basis of the cells isolated from the woman's body. Scientists around the world have managed to recreate the heart valves, nerve cells,bladder,liver,teeth, heart, cornea, and many other organs and tissues.

Cyborgization is the enhancement of a biological being with mechanical or non-genetically delivered biological devices or capabilities. It includes organ or limb replacements, internal electronics, advanced nanomachines, and enhanced or additional capabilities, limbs, or senses. Normally, nanomed medical treatments for anagathic and standard health maintenance are not considered cyborgization, though some societies may consider these common life extension treatments to deviate from the natural Human form. Replacement of body parts with cloned or transplanted human tissue is not considered cyborgization unless such replacements are significantly enhanced [4].

Scientists from Tokyo University have developed a RatCar. RatCaris a type of medical robotic wheelchair. Completely paralyzed people can use the device in the future to facilitate everyday life. Movement in the wheelchair will be carried out with the help of signals received from the brain of the patient. RatCar is a neurorobotic platform built-in rat, in areas of the brain responsible for motor skills, which are sewn the finest neural electrodes. The mouse has the ability to control the device without mechanical impact, just think of the

direction of travel. Rat perceived the robotic platform as a continuation of her body. The main feature of this technology is that the majority of other companies focuses on control by the computer, while as RatCar mobility receives signals directly from the motor areas of the cerebral cortex via implanted to electrons [5].

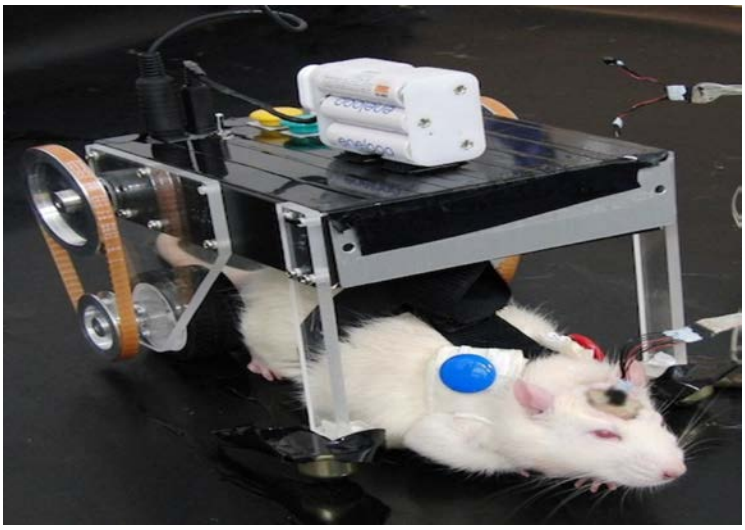

Fig. 2 –RatCar

Researchers trained the rats by making them tow the car, motors turned off, around an enclosed area. A camera tracked the rats' movement and fed data into a modeling program, which pieced together signals from the motor cortex. Then, the rats were hung from the car so their limbs barely touched the floor. The researchers switched the motors on, and as they tried to move, their neural signals were used to drive the car. Six out of eight rats adapted well and were able to get around with the car. According to the experiment, it's not clear how many the rats wriggling might have affected the car's movement; however, scientists want to perform more experiments to address that question.

Based on the survey we can conclude that young people are more positive about bioengineering in contrast to older people. People had generally positive attitude to artificial organs and methods used in bioengineering. Based on all the data presented in the article we can conclude that bioengineering is one of the most perspective areas of science and medicine. Modern prosthetic can facilitate the physical condition of the person and give the possibility to feel through the prosthesis. Cybernetics scientists are developing ways to control artificial limbs by thought. Scientists are able to grow almost all the important organs from the patient's own cells. Most people are ready to apply bioengineering opportunities for yourself and are not afraid to replace their bodies with artificial.

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PARK INSTEAD OF THE HOUSE: EXAMPLES OF ECOREURBANIZATION

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Green zones are one of the most important parts of the city. However, it is very difficult to find enough place for a green zone, which forms own ecosystem in the modern city and functions with the minimum care. In the presence of a huge growth rate of urbanization influence of the humanity on the ecosystem becomes more and more critical. There is not enough space for nature in the cities. The ecology of the cities worsens; people have worse health.Because of the big density of buildings citizens often have no place to walk, and lack of enough greens in the cities reduces the quality of life. It has induced citizens to try to protect the greens remains in cities and stand up for formation of new plantings, and professionals to find new approaches to develop the territories. In this work a number of examples of domestic and foreign practice of replacement of urban areas with recreational has been analyzed. Similar tendencies of similar transformations have been revealed: a park instead of a house.

In professional literature replacement of the urbanized territories with natural is accepted to be calledecoreurbanization. So, in the scientific work of A. Voronina "The principles of‘ecoreurbanization" in architectural space of post-industrial development" the concept of ecoreurbanization is defined as "a complex of strategies and tools introduced in architectural design during the transforming of urbanized spaces of the industrial period based on the ecological approach directed to restoration of communications of the city with the nature, and reconsideration of the place and a role of the nature at the organization of architectural space".Thus, such reconsideration of a functional load of a certain urban area in favor of city ecology, introduction of the nature to the city.

On the basis of the analysis of references and resources from the Internet the examples characterizing tendencies of ecoreurbanization in the world have been chosen. In this research the following qualification is offered:

1. "The Spirit of the place".

In I. V. Kukina and N. A. Unagayeva's grant "Style features of landscape architecture of the second half of the 20th century" this tendency is characterized by "restoration of the broken industrial landscapes" which is based on "landscape and ecological methods of design". But in general a problem of this tendency is preservation of the "spirit" of the place, its historically developed orientation.

A striking example of a tendency of preservation of the "spirit" of the place is the U.S. Embassy in Saigon. It was a symbol of American influence in Southern Vietnam. In April, 1975 during the spring approach (the last and largest land campaign in the Vietnamese war) the embassy was the place of panic and chaos. There was an evacuation of staff of the embassy, the sea guard and the Vietnamese refugees. The embassy has been plundered. The building has been engaged in the 1990th with a Vietnamese oil company. In 1995 when diplomatic relations were restored and the USA received the real estate back, people were very surprised to find the objects which have remained since the war (bags with sand, etc.).

Then the major part was destroyed andthis space was used to make a park. So, the reconstruction of the place was delicate, keeping the main orientation of the territory. Also the memorial plate in the memory of the dead during storm of embassy has been established in park.

Also the Public park Gezvork in Seattle (the State of Washington (USA)) should be noted. The project of this park at the territory of the plant producing gas and coal was developedby RichardHaagom in 1973. At thattime the enterprise became unprofitable and was closed. The abandoned territory was located on the cape which was well looked through from many parts of the city. In 1962 the city got this site for creation of a public park, and the soil were restored and trees were planted. Richard Haag made the decision on preservation of the "soul of the place" and took the remains of plant - dark rusty towers - as a basis of the composition; they are the basic vertical elements of the park and a reminder of the industrial past of the territory.

2. "Green priorities" in the ideas of master plans of the cities

This tendency of ecoreurbanizationis characterized by release of urban areas for creation of continuous gardening in the city.

An activity of town-planners of the city of Omsk would be a good example.

Omsk, the 1980s. With the expansion of borders of the city across the river Irtysh, the question of demolition of barrack-type housing for release of the place for city spaces came. It was offered to form a new residential district around, and extension of railway tracks. The architect M. Markova visited the designed territory and found a huge number of dense vegetation in gardens near houses. After that the concept of the project was seriously changed. The direction of the prospectus was changed and practically all vegetation was kept. Due to the change of a corner of the prospectus the residential district became closed for drafts from the near street.

Also in Moscow there was a demolition of “TheRossia” hotel quite recently for construction Zaryadye park on its place. And the American bureau Diller Scofidio + Renfo became the winner of an architectural competition with its project of reproducing natural shapes. "4 landscape zones typical for Russia were carriedto the territory of the park: northern landscapes, the steppe, the wood and ponds, which go down terraces from the top level of a site to his lower part, from the northeast on the southwest. They crosseach other, accumulate with each other and conclude in themselves the main objects of the park."

3. Local garden

This tendency is characterized by demolition of shabby housing in order to form a small park for locals.

Projects of dismantling of empty houses in peripheral inhabited residential districts of the Eastern Germany for the purpose of the organization of parksto increase the prestige of these residential districts could be great examples of ecoreurbanization. After the falling of the Berlin wall in residential districts Gorbitts and Prolis in the east of Dresden the number of the population sharply decreased, as people tried to move to more elite houses. The authorities made the decision of demolition of a number of houses and formation of a park for the neighboring houses. The idea was successfully well and people returned to the neighboring houses very quickly.

It is also possible to find several examples of demolition of houses in favor of greens in Krasnoyarsk. For example, a situation on Shakhterov St. Instead of old wooden two-storeybuildingsa park was built; there was an essential expansion of the highway, and all the inhabitants were moved to new houses. The territory was cleared, old trees were cut down, and new onesplanted. Thus, this green zone will start functioning in several years.

Another local exampleis placed onKopylova St. The same story as atShakhterov St., but here the demolition of buildings was very delicate and practically all vegetation remained untouched, so soon a new park will appear on this place.

4. Historical justice.

There is a number of examples withthe restoration of territorial historical justice, whenearlier existing green places that had been occupied with buildings during a certain period of time were returned to the city.

In thephotothere is a small green zone in Sevastopol down theCapitanskaya street, 2002. Apparently, there are many footpaths on which people walkthrough this territory. Till 2014 there had been the construction of 16 floor houses. Local authorities made the decision on recognition of the structuresillegal, and after a certain amount of time and hardnegotiations they were demolished from the third attempt. According to the mayor of Sevastopol, now there will be a park.

5. Social activity in the struggle for the place of the nature in the city

It should be notedthat the increasing activity of citizens in the fight for greens is a separate tendency. In many cities of Russia there are the cases of the turning of lands from inhabited or business torecreational ones, which attracts modification of the existing Rules of Building and Land use.

In conclusion, ecoreurbanisation is a potential method of preservation and extension of "green lungs" of the city. During the work on development of the existing urban areas by town-planners, authorities and inhabitants ought to think of revision of some functions of buildings in favor of introduction of the nature to the city. The simple truth of the architect Vitruvii should not be forgotten: "Advantage, Durability, Beauty". Always the advantage is on the first place. And green zones in the city are much more useful than a new shopping center.

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CHALLENGES FOR THE RUSSIAN IT INDUSTRY

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Last years, the Russian economics is undergoing a serious problems such as energy prices have fallen, dependence on raw material exports has increased and consequently the currency has decreased, so the country's economy has suffered. The way out of this situation is the transition to an innovative economy based on the flow of innovations, constant technological improvement, manufacturing and exporting high-tech products and technologies. In this type of economy, the products of Russian companies will become competitive in the global market and will be able to find demand among consumers and overall improvement in the economy will have a positive effect in the social sphere. The Russian government carries out reforms and introduce the concept of long-term socio-economic development of the Russian Federation (Strategy 2020[1]), but these measures have insufficient impact, and the Russian goods remain noncompetitive in the global and Russian market. In this article, we will try to answer the question "Why Russian goods are not competitive", and to find possible solutions to this problem, on the example of the market of information technologies.

To date the total volume of the global IT market is more than three and a half trillion dollars. IT market is one of the largest and fast growing. In addition, pair of key features makes it unique. First, the application width - in present society it covers actually all spheres. Secondly, the flexibility of use - initially computer was created for a scientific purpose, but then other ways of its application were discovered, which initially no one thought, so innovations in information technology appear very often, and many of them are quite successful. Thirdly, with the development of the Internet, it became easy to sell such products as the software. Moreover, it brings big profits taking into account volume and rate of growth of the market of information technologies, as well as its uniqueness, it could be said that who owns IT – owns the world.

According to the President of Russian Communications Corporation EvgeniyMelnyk, the information technology sphere should be a full-fledged branch of the Russian economy, creating high-tech job opportunities and ensuring the production of competitive products. That day, Russia had all the necessary elements to achieve that goal: political will, the advanced scientific developments, highly professional teams of high-tech equipment developers and software.

However, the total volume of IT products produced by companies in the Russian IT industry is about 0.6% of the world market. Domestic IT industry meets the needs of the Russian IT-market by 25%. In the segment of IT equipment, virtually all-domestic demand being met by imports. Software and hardware manufacturing segment is represented in many companies, which involved in equipment assembly under local brands produced mainly within foreign components. The level of technology and productivity lags behind world standards [2].

As far as can be seen from the above data, the Russian IT industry is in very poor condition. Russia is losing huge profits on the foreign and domestic market, and IT growth though have shown good results for several years, and projected growth will only continue - this is not enough and the gap between the leading countries will be maintained, and in some increase market segments.

The origin of all problems of the Russian IT industry, in addition to historical, is the lack of funding from the state and the lack of IT professionals in the state apparatus.

IT industry is young, many in the government are poorly versed in it and often not taken seriously, so many programs of development, and support for a long time avoided the IT side, and only in recent years has seen a reverse trend. The funds that the government invests in IT are going to support unpromising and secondary projects, which have many analogues abroad. In the end, these invested products are far behind in their characteristics from the nearest foreign counterparts, as well as unpopular and expensive, and consequently it has not a commercial success, not only in foreign markets, but also in Russia. Therefore, there are government orders created, which are motivated by import substitution and information security in order to prove the investment is worth the cost, but these actions do not meet the innovation economy and lead to inefficient spending of budget funds.

An example would be Computer "AWP Elbrus-401" based on domestic chipElbrus-4S[3]. The technology is based on this computer looks promising, but now its performance is significantly inferior to foreign counterparts. The demand by the State due to high reliability in information security system, but the balance between price and performance is significantly inferior to its closest competitors [4], and the operating system on this computer is based on an open source system-OS Linux, what leads to doubt about high reliability. From this, we can conclude that the Computer "AWP Elbrus-401" needs considerable refinement and only then could be produced.

As one of the main problems is the weak support for start-ups and the law imposes significant restrictions on young companies, inefficient system of customs duties, setting the domestic business computer assembly, and imperfect legislation in the field of intellectual property protection. As you know, many companies - leaders of today's IT industry began with a group of enthusiasts who create innovations in their garages, but this would not have happened if not for the United States to this favorable environment and system of laws.

Foreign companies that have worldwide recognition and greater financial base, deeply settled in the Russian market, Russian companies and institutions used to trust foreign producers more, and professionals prefer to work in foreign companies for many reasons, so most young Russian companies lacking money funds are not able to break into the markets.

In the software segment, the company, which still managed to break into the Russian market, the most commonly used solutions and strategies have long been successful in the West. Within the Russian segment of the IT market, they are to some extent innovative and highly successful, but outside of Russia market meet the hard competition and lack of success in his promotion.

It is difficult not to draw analogies between «Yandex», «Mail Group» and «Google», «VKontakte» and «Facebook». Moreover, at the same time from 40% up to 50% of the turnover of one of the leading representatives of the Russian IT market - "LANIT" provides distribution of hardware and software.

In the hardware segment, domestic manufacturers due to lack of funds and technological knowledges, are not able to build the production of high-tech IT hardware in the country. Therefore, the Russian brand products assembled from imported components or fully manufactured in China, Taiwan and other Asian countries. In contrast to USA companies, production is based on the technology of producing countries.

24 February 2014 smartphone developed by the Russian company Yota Devices was presented at the Mobile World Congress in Barcelona. It was called "Domestic", but the YotaPhone 2 is actually a true mix of foreign components such as Gorilla glass by American Corning, the technology of "electronic ink" by Taiwanese company E-ink, Qualcomm (USA) and more, country of assembly is China. After all, is it possible YotaPhone 2 to be called Russian smartphone? [5]

At this stage, domestic producers of hardware and software need the support of the state, including financial support, to advance in the international market.

An example of ICT success protectionist state policy has become China - Today, with the support of the Chinese government's hand high-tech companies not only retain a significant share of the domestic market, but also carry out an intensive expansion. Nowadays, China's computer manufacturers occupy the top ranks of the world's high-tech equipment sales rankings.

The secret of the success of the Chinese high-tech is a large-scale government program to support domestic manufacturers of high-tech products. Chinese system resembles a ladder, where at transition to each next step, mutual obligations of the company and the state are rising. To date, local producers occupy about 60% of the Chinese market.

To conclude, the government plays a major role in solving problems of the Russian IT industry. Without a balanced state policy in the field of the internal market of IT solutions, without the support of the Russian manufacturers in entering the markets of other countries and without stimulating personnel policy the domestic IT industry will not be able to realize own potential.

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УДК 539.21

METAMATERIALS

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Production of new materials is rapidly advancing. Researchers try to find the highest qualities, lower cost and efficiency for mechanical industry. This development has been greatly improved so there are varietiesof innovations in this field.

One of them is a metamaterial. It's an artificial composite dielectric with special microstructure and material properties, which enable the manipulation with visible light and electromagnetic waves. These characteristics are significant for nanoscience, optics, electrical and microwave engineering.

Materials are divided into left-handed and right-handed media. It is connected with the vector triplet – E (electric field vector), H (magnetic field vector), k (wave vector) and also with μ (magnetic permeability) and ε (absolute permittivity). From Maxwell equations we can conclude:

$$\begin{cases} \vec{k} \times \vec{H} = -\varepsilon\omega\vec{E} \\ \vec{k} \times \vec{E} = \mu\omega\vec{H} \end{cases}$$

For media, where ε and μ are positive, the triplet is right-handed and wave propagates normally. It's indicative for almost all materials. Also in materials with this media the Poynting vector $\vec{S} = \vec{E} \times \vec{H}$is parallel to the $\vec{k}$. But this vector triplet can compose a left-handed triple, where ε and μ are negative.(See Fig. 1)

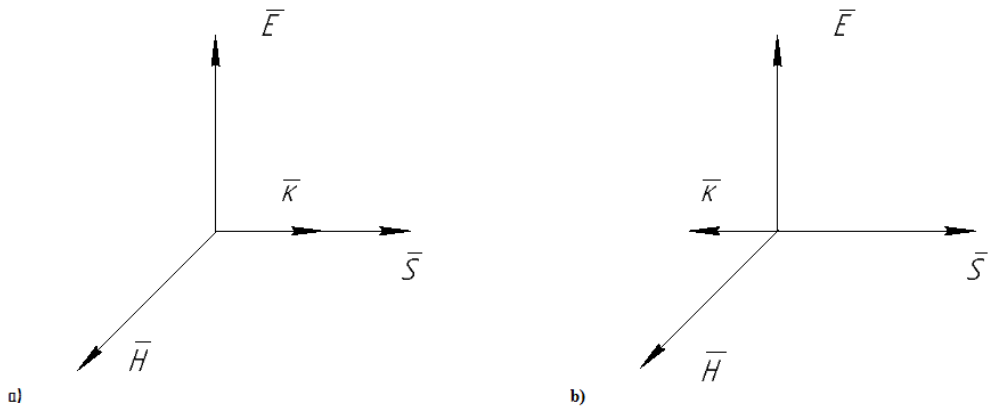

Figure 1 – a) right-handed media with the vector triplet and the Poynting vector, b) left-handed media with the vector triplet and the Poynting vector.

If ε and μ both are changed from positive to negative, right-handed media turns into left-handed media and the Poynting vector becomes antiparallel to the wave vector$\vec{k}$.

Metamaterials with left-handed media are also known as negative index metamaterials (NIM) or double negative materials (DNG). Their main property is a negative refractive index for visible light.Laws and foundations of geometric optics don't match for metamaterials lenses. For instance, converging lens made from DNG will be diverge light rays. The Cherenkov radiation and Doppler shifthave inverse effect.

This achievement led to creation of superlens. Ordinary lenses are constrained by diffraction limit, but superlens can overcome it. Victor Veselago was the first scientist, who developed a theory that material with negative refractive index $n = -1$ will have different and unique lens qualities. 32 years later David Smith created the first known example of left-handed metamaterial with negative refractive index.

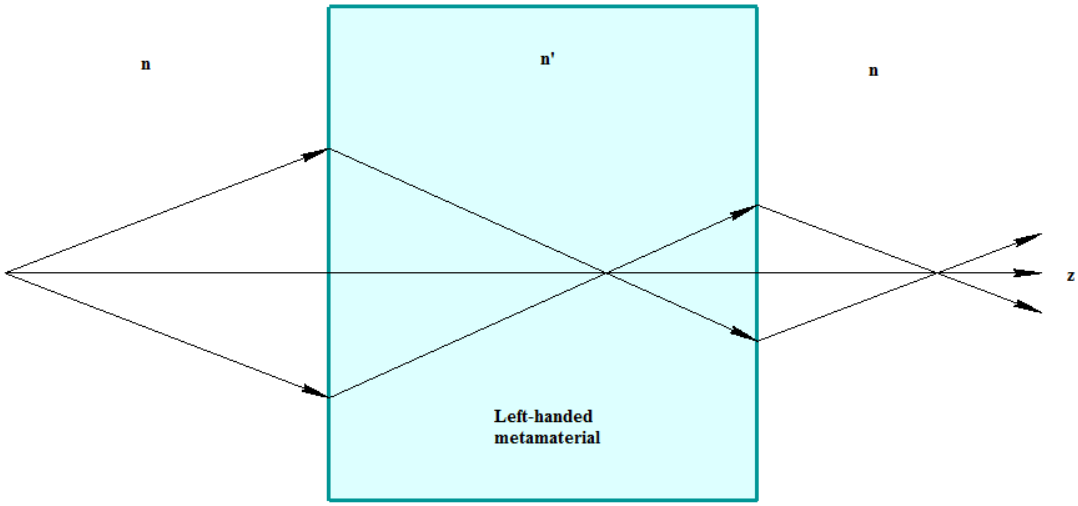

Figure 2 – Example of light rays passing through superlens.

After forty years of theory developed by Veselago, Richard Blaikie and group of scientists experimentally proved operating concept of superlens by a very thin layer of a metal. They applied a layer of silver width of 40 nm used as a metasurface to receive image of exposing light with wavelength of about 365 nm, which was greater than the width of a slit.

As well, scientists were curious about invincible materials, which can help to cover something. Sir John Pendryworked and realized the theory about physical qualities of camouflage materials. There is an optical phenomenon named invisibility cloak. Object located inside invisibility cloak and electromagnetic waves collide into surface of a cloak and envelope it. David Smith (a scientist who created the first metamaterial) also invented a functioning cloak, where object stays invincible in microwave wavelengths.

Researchers came up with an idea for civil engineering. It's called a seismic cloak. It can shield buildings from damage of earthquakes and tsunamis or minimize damage from it. Thanks for metamaterials cloak seismic wave energy will envelope building and leave it untouched.In recent years in Franceengineers had large-scale test to see feasibility of this idea. They used monochromatic acoustic waves, but calculated their speed similar to Rayleigh wave. Sensors scanned wave intensity in exploring area with seismic metamaterials and without it. Results satisfied scientists, but there are many work and problems. Even if buildings will have this protection cloak from real Rayleigh wave, there is a question – where scientists must redirect the wave energy.

Metamaterials are also used in radio engineering. Antennas made from metamaterials are useful for reducing in size, reactivity compensation in broadband, antenna horn arrangement. There are many application fields such as space communication, satellites, airplanes, wireless communication.

Metamaterials are unique field with unexposed potential. There are manifold of theories and ideas, but there aren't a lot of realistic conditions. Manufacturing processes and advanced applications solutions will lead to absolutely new products and developments for multiple disciplines.

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УДК 620.4

CRYOGENIC ACCUMULATING POWER PLANT

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Till nowthe way of accumulation and electricity storage in large quantities required for industrial power hasn't been found. Power consumption significantly varies during a day and depends on seasons, so to ensure a reliable power supply is necessary to create a power generation capacity of maximum consumption, whereas,the facility remain unclaimed the rest of the time. In some cases there is over-supply of electricity and power plants have to sell it at "zero" or even "negative" prices, in order to avoid expensive stopping and then starting operation.

Today there are several ways to optimize energy systems. There is forced decrease in generation of electricity, consumption control, and, of course, accumulation of electricity.

The most common way of accumulation is pumped-storage plant(PSP).

Picture 1.Zagorskaya PSP

Today in our country there isonly one station: Zagorskaya. But Zagorskaya-2 will start working in 2017. They are both located on river Kunya near the village of Bogorodskoein Moscow region. **[pic.1]**

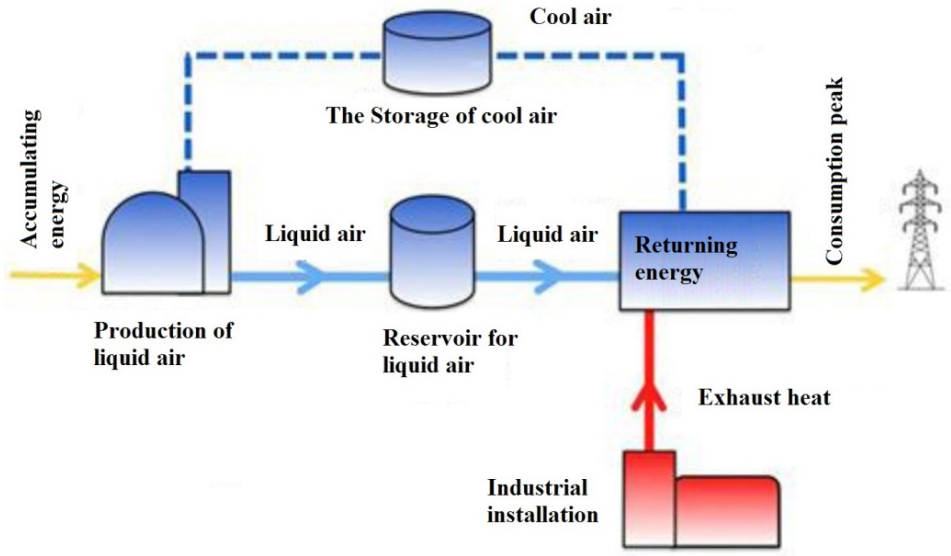
For operation of such plants it is necessary to havetwo pools located at different levels. Between them there is a pipeline connected to the building of the pumped-storage plant, here there are some special hydraulic units having the opportunity of working as a pump and as a turbine. At night the PSP performs normal pump operation, pumping water into the upper pool, and thereby, consumes the energy from power system. In the morning and evening the plant does turbining, operating as a conventional hydroelectric plant, and returns the energy to power system. In addition, a pumped-storage plant can be put into operation quickly at any required power, compensating the consequences of accidents in power systems.

The efficiency of a modernpumped-storage plant is 70-75%.It is reliable, well tested, has high operating mobility, which allowsto avoid overloading. But it has serious disadvantages. As a matter of fact, the pumped-storage power station is a massive structure that requires high capital investment, special geographical zones for its construction,the availability of water and altitude drops.

Therefore, it is unreasonable to talk about the PSP as an ideal solution of the problem in energy storage.So, one of the promising methods of energy accumulation and storage is the use

of cryotechnology or, differently, "cold conversion", otherwise the use of cryogenic accumulation power plant.

The professor of Leeds University, Yulon Dean is supposed to have been the author of this idea. It is concerned to the utilizationof excess energy generation by liquefaction of atmospheric air (in fact, nitrogen) in industrial cryogenic installations. It is suitable for the systems with a highproportion of unstable sources, such as wind and solar power.



Picture2.Technological scheme CAPP

The principle of its operation is to use the energy stored in the cooled air. During minimum loads in the network the energy fromthe power system is consumed for pumping the air from the environment, filtering and cooling it up to minus 196Celsius degree. Thus the liquefied air is stored in special insulated containers. During the peakednessthe liquefied air goes into the evaporator, it is expanded in 700 times or more and rotates the turbine.**[pic.2]**

In the spring of 2011 in the UK a pilot CAPP on 350 kW was put into operation. The mounting of the station took only 2 months because there was production run equipment used in it. The makers of the station note that during heating the liquefied air by atmospheric air only 50% of the energyhaving been spent before on the liquefaction of air is returned into the network.However, the use of additional heat from any industrial facility (in this case the heat was received from the equipment of their plant) increases the efficiency up to 70%.

By the reasons of production run equipment and independence ofplacement the CAPP can be cheaper and more mobile than the PSP. It is necessary to note that the storage of liquid air is much safer than the storage of natural gas or fuel oil. This opens the possibility to transport containers with cooled air over long distances. The combination of all these factors gives extensive prospects for using the CAPP during load control. It is important tomakegood conditions for the technical and economic advantages compared with the known methods of regulation of energy consumptionin power systems of the Russian Federation.

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УДК 721.011.12

HOUSE PLAN – EIGHT ESSENTIAL CONSIDERATIONS DURING DESIGNING

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Designing the house – is not an easy job, requiring certain knowledge and skills. Make a plan of the house by yourself is possible, but it needs to take into account many parameters beginning from the number of rooms to the functional parts of the interior.

This article will list out 8 of the most essential considerations when you determine your house plan.

1. House which is suitable for your family andlifestyle

Choose a house plan which is going to suit your family with enough bedrooms and space for everyone to have a little privacy. If you are a couple planning on extending your family make sure there is a room to have a nursery and eventually have additional bedrooms. If you are single living on your own you need not a house that is verybig.

Consider adding a media room if you enjoy watching movies or playing video games or have a terrace if you love gardening. So if to talk about Russian and American houses both of them contain large number of rooms for a whole family or even for the staff.

2. Efficient workspace

Don't forget the work areas of your house and plan them in a way that is practical, functional and also comfortable. Having a bigger laundry is a good idea if you have a family with plenty of storage space and added conveniences like an ironing board that folds up into a wall space. Have a kitchen that is central to your house so family members can all gather around there in the evenings while the evening meal is being cooked. If you work from house or have teenagers an office or study space is also a great idea.

3. Combining the functions

The current trend combining the space into one, no doubt, has its pluses and minuses. The free space includes a number of related functions: kitchen-dining room, living room-library, bedroom-dressing room and so on, but, however, requires additional methods of zoning. It will suit you better if you haven`t got enough space in your house. In most of cases people create «studious» to save the space and combine living and dining room, this tendency is used as in America and in Russia.

4. Privacy against neighboring

Plan your house so that you have privacy from the neighbors. It's better to direct your house not in front of the neighbor's windows and yardand plan it with space for a garden and large trees so you can block out any neighboring buildings.

For example in Russia people usually buy a large territory to built house and create a garden that`s why neighbor houses are placed on enough distance but in America neighborhood is inevitably because private houses are located in a town next to each other.

5. Energy efficient and eco-friendly house

Having an energy efficient house makes a lot of sense nowadays with the cost of electricity rising and the need to put less pressure on our natural resources. Think about having smaller windows on the west side of the house or a veranda to shade your house from the hot afternoon sun. Install energy saving appliances and water saving shower heads and taps.

The most common thing in the world to receive the natural energy is solar panel. In

America it spreads more than in Russia because not in every region of the country is possible to get enough solar energy to provide house with electricity and heating.

6. House construction progress

When building your house you should think about what materials to construct it from that will suit the area, save you money and that are more environmentally friendly. The quality of the house, its strength, durability should be the main factors in the use of certain technology and material. Modern building materials are being developed for the following purposes: efficient energy saving and sound insulation, light weight structure, rapid construction, ensuring a comfortable indoor climate

For example steel frame houses are more fire and termite resistant, plus they are more environmentally friendly.

For example Americans used to build wooden framed houses while Russians apply such materials as brick, steel, concrete and glass.

7. Change the space in one motion

The use of modern mobile partitions which allow you to create a dynamic space helps a lot in the merger of the two previous methods for the formation of a solid interior. Sliding doors and walls make the space comfortable and ergonomic. Design and variety of portable partitions deserves attention. The panels of these elements are often decorated with different coatings - wood, mosaic, mirror materials, etc. that allows you to choose the most harmonious product for your interior style.

8.Organization of full storage sites

Designers for example proved that the view of insufficient space for a dressing room is often erroneous. Sometimes it is much more practical to create a dressing-room zone instead of dressing cupboards in every room. It is better to use chests of drawers, bollards and small cabinets in addition to dressing room. Nowadays this designing consideration is using in both countries if the owners of the house can allow it to themselves.

Build your own house, so that it matches all the requirements, wishes and even the dreams of all family members is not easy. The basis of it is laid at the design stage. Therefore, the more the master of the house will do independent work, the more house will correspond his wishes. Designing your own home allows you to fully realize all your creative ideas, because you get to decide how it will look your new home so to live in their own home-designed much nicer

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УДК69.033.8

NOMADIC ARCHITECTURE

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Mankind's first venture into architecture thousands of years ago wasn't exactly high-rise buildings or incredibly ornate structures. The very first structures that mankind constructed were portable, allowing them to be built, dismantled and rebuilt as they moved from one location to another as the seasons changed.The name given to this type of architecture is the nomadic architecture.

This form of architecture still influences design to this day, often falling into one of several categories:

– mobile structures for events or exhibitions;

– mobile/temporary shelter in extreme conditions (e. g. remote environments or in the aftermath of natural disasters).

In 2019 Krasnoyarsk is going to hold the 29th Winter Universiade– a youth analogue of the Olympic games that has been the second most important and representative complex international event on the world sports arena for more than 50 years. That is why we decided to analyze the experience of cities that are going to host sports games or different competitions and howtheysolve problems with the buildings that may become expensive to maintain or difficult to dispose of. The concept of "nomadic architecture"can be considered as a way to solve this problem. The best way to understand it is to learn the experience of Rio de Janeiro.

The nearest significant sporting event is the Summer Olympic GamesinRio de Janeiro, Brazil. Events will take place at eighteen existing venues. One of the cities that they most turned to for ideas was London, which held the Olympic Games in 2012, so they brought many experiences from there. One of them was the "nomadic architecture" and so they are building networks that will be used for social activities. The nomadic architecture experience, including the name, was brought from London.

Eduardo Paes, mayor of Rio de Janeiro, explains how the Olympics will transform the city well beyond 2016: "We have also looked for simplicity while meeting Olympic quality standards. A "third commandment" was to avoid "white elephants" after the games. In addition to using existing venues and focusing on sustainable design, we prioritised lean construction and long-term planning, developing a concept we call "nomadic architecture". Temporary Olympic arenas will be reassembled as public facilities in the city's poorer areas. The handball stadium (Figure 1) will be transformed into four public schools when the competitions are over. The aquatic centre (Figure 2) will become two public gymnasiums."

Thus, using "nomadic architecture" for the first time in Olympic history, the sporting venues will leave a legacy for the city's young people.

Fig. 1- Olympic Hall 4

Fig.2 -An aerial view of Maria Lenk Aquatic Center

In the first picture (Figure 1) is the Olympic Hall 4. During the Rio 2016 Olympic and Paralympic Games, it will host the stars of handball and goal ball. When the Games are over, it will be full of children studying.

Thanks to an innovative technique called “nomadic architecture”, the sportsstadiums will leave a lasting legacy to Rio de Janeiro, in the shape of severalpublic facilities.

The venue was originally planned, when Rio was preparing its Olympic bid, as a permanent structure. After the Games, it was to form part of the Olympic Training Centre (OTC) – Rio 2016’s main sporting legacy – along with Olympic Halls 1,2 and 3. However, further analysis revealed that three halls met the OTC demand, so in order to avoid constructing a venue that would not be fully utilized after the Games, a creative solution was found.

From the beginning of its design, the 12,000-seat arena in the Barra Olympic Park has been developed with a view to its legacy. When the sports mega-event is over, Olympic Hall 4 will be dismantled and its components will be reused in the construction of schools.

Rio 2016 President Carlos Nuzmansaid: “Converting the Rio 2016 handball arena into four schools after the Games is an excellent example of Rio’s commitment to ensuring the 2016 Games leave tangible benefits for the local community. The nomadic architecture concept defined by our government partners is a first for the Games and we are proud that 2,000 Brazilian schoolchildren will benefit from it for many years to come.”

It is important to mention, that this is the first time that this concept of nomadic architecture will be used in the Olympics, ensuring that even a temporary venue can provide a tangible legacy for the city.

Having studied this contemporary method carefully, we can understand how to make sometemporary venues of the Universiade more useful for Krasnoyarsk. Lastly, using of innovative methods is an opportunity to add value to the city’s brand, improving services and attracting global attention and visitors. It will be a good way to improve infrastructure and increase quality of life.

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УДК621.352.6

HYDROGEN FUEL CELLS

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Hydrogen fuel cells are a highly efficient, reliable, durable and environmentally friendly way to generate energy. William R. Grove is believed to bethe inventor of a fuel cell. He made it in 1839. In this fuel cellthe solution of sulfuric acid was used as electrolyte and hydrogen,combining with oxygen in an oxidizer environment- as the fuel.It is necessary to notice that fuel cells have been used in laboratories and on spacecraft until recently. At present fuel cells are increasingly used in various fields - as stationary power plants, engines of vehicles, autonomous sources of heat and power supply of buildings.

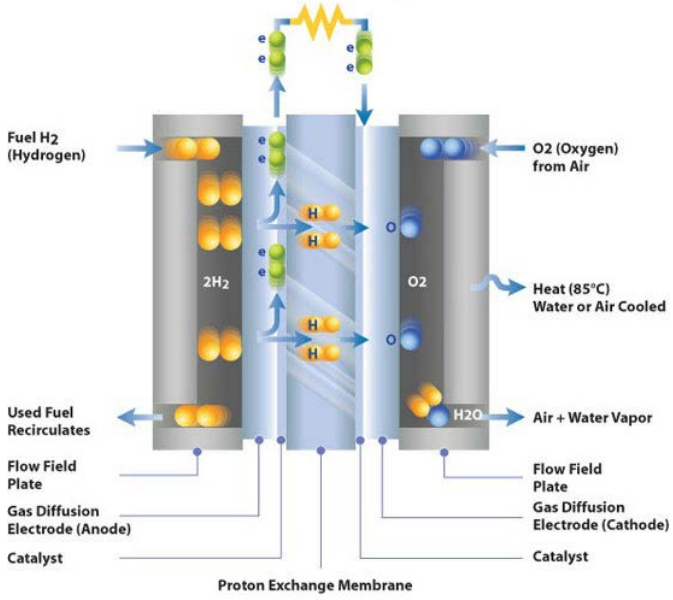
Hydrogen fuel cells run vehicles and other machines by directly converting the chemical energy of hydrogen into electrical one. Hydrogen is an abundant fuel source and it can be extracted from water, that is, almost any country can produce it domestically. Hydrogen fuel cell engines power vehicles are stand-by generators for large-scale productions. They produce electrical power without any emissions. The only waste product is water.

There are several types of fuel cells, which are differentby being used chemical processes. Fuel cells are usually classified by the type of using electrolyte. For example, such as: alkali fuel cells, fuel cells based on phosphoric acid, solid oxide fuel cells. Some types of fuel cells are promising for application them as power installations, while others may be useful for small portable devices or driving cars.

The operating principle of the fuel cell

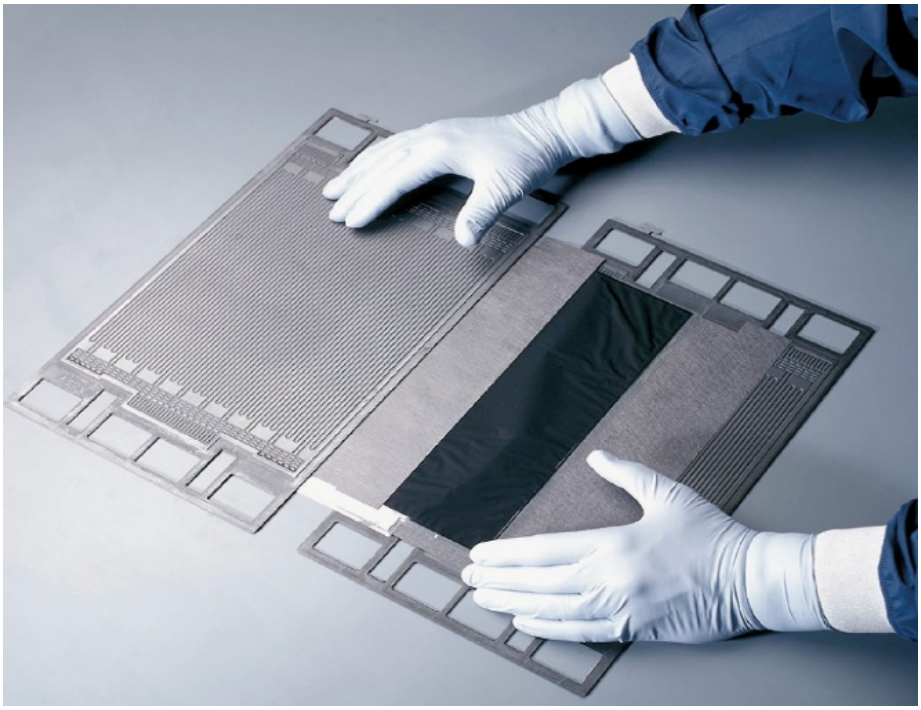
In the fuel cell,the electrochemical process of hydrogen compound with oxygen obtained from the air is applied.This is clearly shown on Pic.1.

From a practical point of view a fuel cell resembles a conventional galvanic battery. The difference is that the battery is initially charged, i.e. it’s filled with "fuel". During operation the "fuel" is being consumed and the battery is discharged. Unlike the battery, a fuel cell for producing electrical energy uses the fuel supplied from an external source.



Pic.1 - Basic scheme of hydrogen fuel cell operation

In the heart of the engine running on hydrogen there is a stack of thin hydrogen fuel cells. The engine's fan takes in the air thenfrom the fuel tank the hydrogen is given. Hydrogen and oxygen reacteach other and generate electricity. Each fuel cell consists of several parts, on each end of them there are corrugated plates made of carbon alloy, which conducts electricity. These plates "act the part" of electrodes (anode and cathode, respectively). (Pic.2)



Pic.2 - Separate element of the fuel cell

Hydrogen is supplied to the cell through the first plate and transmitted to the next component - chemically treated paper, which conducts both gas and electricity. Chemically treated paper acts as a catalyst. It is a special material which facilitates the reaction between oxygen and hydrogen. The catalyst is usually made of platinum powder deposited on paper or cloth by a very thin layer of carbon. Then, the hydrogen goes to a special proton-exchange membrane where it is split into protons and electrons. Proton - exchange membrane (electrolyte)- is a special material, resembling ordinary plastic, but has the ability to skip the positively charged ions and block electrons pass. The protons react with the oxygenproducing water. After the water passes through another sheet of paper to the outer plate of a cell and is drained by a pump. Meanwhile the electrons reach the end of the stack of fuel cellsand go to electrical wires.

Advantages and disadvantages of fuel cells

Fuel cells are more energetically efficient than internal combustion engines. The efficiency of fuel cells is about 50%, while the efficiency of internal combustion engines is about 12-20%.

The fuel cells have no moving parts, at least, inside them. Naturally, they have greater than 50% efficiency and especially, they are effective at low loads. Thus, vehicles with fuel cells are ready to become (and it is already proved) more fuel efficient than conventional vehicles in real-world driving conditions.

The efficiency of fuel cells increases even more when using heat and water.

Unlike, for example, the internal combustion engines the efficiency of fuel cells remains very high even in the case when they do not operate at total power. In addition, the power of fuel cells can be increased by simply adding the individual blocks.

Fuel cells can be placed directly in the building, it decreases the transmissions loses of energy, and the heat generated by the reaction can be used for heating or hot water supplying the building itself. Autonomous sources of heat and electricity can be very beneficial in remote areas and in regions which are characterized by the power shortage and its high cost, but at the same time, there are reserves of hydrogen-containing raw materials (oil and natural gas).

The advantages of fuel cells are also fuel availability, reliability (in a fuel cell has no moving parts), durability and operating simplicity.

One of the main drawbacks of fuel cells today is their relatively high cost, but this disadvantage can be overcome soon. There are more and more companies producing commercial samples of fuel cells. Theyare continually being improved, and their cost is being reduced.

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SCYLE: SMART HOMES AS THE FUTURE OF EFFICIENCY

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Technology allows homeowners to further personalize the environments in their homes and to monitor their homes remotely. Consider the increasing popularity of smart appliances such as motion-sensor lights, programmable thermostats and sound-control surround systems. Such technologies will likely expand as ways to make homes not only more comfortable, but also safer and more efficient. Smart home technology is becoming increasingly affordable and will become increasingly common in new homes. "Smart Home" is the term commonly used to define a residence that has appliances, lighting, heating, air conditioning, TVs, computers, entertainment audio and video systems, security, and camera systems that are capable of communicating with one another and can be controlled remotely by a time schedule, from any room in the home, as well as remotely from any location in the world by phone or internet.

According to Cisco IBSG there will be 25 billion devices connected to the Internet by 2015 and 50 billion by 2020[4]. For this reason the innovative expanding networking system is needed to operate devices connected to the Internet. One such solution is a smart home system.According to the Strategy Analytics dataabout 20 million people in Americahave already implemented this system in their houses[5].About 90% of usersin Russia are located in Moscow and St. Petersburg [2]. But the Smart home is a topical for otherRussian cities, including Krasnoyarsk.This is evidenced by statistics of Russian EMERCOM: from January to September 2015 there were 106 179 fires, were killed 6402 people and caused material damage amounted to 11 927334 rubles [3]. In 29640 cases of fire there are the violation of the rules of the device and operation of electrical equipment and household appliances [3]. The smart home systemis able to detect the early stages of the problem and inform the owner that can improve his home security.

The implementation of the smart home system is benefit for Russia and the Krasnoyarsk Territory with long and cold winters. Consumers try to save, and Smart home allows them to control the correct operation of lighting, appliances, heating.

Key Features:

1. appliances control;
2. Multimedia system control;
3. video surveillance and camera monitoring;
4. smoke and CO sensors;
5. leak detection;

Additional options:

1. drapery control;
2. thermostat control;
3. door control;
4. motion detection;
5. low voltage contol.

Smart home is not only a system for a comfortable and easy life, but it also helps people to look after their health and the health of loved ones, check the parameters and progress during fitness training.

The system includes:

1. Smartwatches, which allow you to track rapid phase of sleep in humans for comfortable awakening;

2. The fitness trackers that monitor metrics such as distance walked or run, calorie consumption, and in some cases heartbeat and quality of sleep;

3. The climate control system, which creates the perfect microclimate for the health: the favorable parameters of temperature and humidity, certain options for each room;

5. Pressure and pulse monitoring. This is a function that allows you to monitor heartbeat, blood pressure and other parameters during training.

The Smart home system is necessary for disabled peoplewho need to take medicines every day. The research shows thepotential time and electrical energy savings of implementation of the smart home system. During the year a person spends about 6 hours on turning on and off lighting and appliances. Nowadays homeowners are able to set up systems that program the house doors to unlock, certain lights to come on, and the thermostat to adjust to preselected settings automatically when someone arrives at the home.

Smart homes combine networked interconnections with energy savings to provide convenience, improve the cleanliness of your clothes and dishes, keep your food fresh and help you cook your meals.

To highlight the most important functions of smart home for people, the survey was carried out. 10 students and 10 people aged 18 to 58 took part in the interview. According to the survey the majority of respondents feel uncomfortable and forget to turn off appliances and lights in the other rooms, nearly 100% of respondents would like to save on electricity, so the most important functionof the smart home system is lighting and appliances remote control. Also, the majority of respondents consider Smart home as the solution to the question of health inspection and children monitoring. 3/4 of the respondents would like to automate processes in the house, on the other hand only 60 % consider setting up of the Smart home system.

In order to examine the implementation of Smart home system into the private residence and apartment were created two 3D-models: a two-storey cottage(Fig.1)and one-bedroom apartments(Fig.2).

Fig.1 - 3D-model of apartment with Smart Home system

Fig.2 - 3D-model of a private residence with Smart Home system

Taking into account all the data we can conclude that the Smart home system is not just a luxury, but the innovative expanding networking systemthat monitors and secures homes in minutes. In the future, the smart home system will be used not only in commercial organizations, but also will be available to the majority of people.

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DESIGN DRIVEN INNOVATION

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According to the international standard ISO 9000 for quality system management, a typical product life cycle can be divided into 11 stages:

- marketing;
- research and development;
- logistics;
- development of production process;
- production;
- modeling and testing;
- packaging and storage;
- sales;
- commercialization;
- services;
- recycling after use [4].

Development of product packaging is the 7th stage in the product life cycle, which indicates its importance. Package design is associated with the appearance of the product, the product idea and design. The effect of the design on almost every stage can be observed: marketing - advertising, packaging; research and development - the appearance of the product. Design affects the uniqueness, usability (ease), the correct embodiment of ideas, vision and innovation.

According to the Oxford English Dictionary design is the art or action of conceiving of and producing a plan or drawing of something before it is made [3]. It is necessary to elaborate design in order to introduce an innovative product to investors or consumers properly. It is also necessary to draw consumers' attention to the importance of the product.

Until now, the literature on innovation has focused either on radical innovation pushed by technology or incremental innovation pulled by the market. In Design Driven Innovation, Roberto Verganti introduces a third strategy, a radical shift in perspective that introduces a bold new way of competing. Design-driven innovations do not come from the market; they create new markets. They don't push new technologies; they push new meanings [5].

Russia has been ranked 14th intheGlobalInnovationIndex 2015, a rankingof the world's 50 most innovative countries carried out by Bloomberg [1]. Design development (in particular industrial) can improve rankings, because recently often products are not ergonomic (inconvenient), are attracts attention not always.

GFK is the trusted source of relevant market and consumer information that enables its clients to make smarter decisions. GFK has conducted a survey. Over 26 000 smartphone owners from 22 countries including Russia have taken part in this survey. Over 30% of respondents consider design as the most important factor that influences on the consumer behavior. Only 9% of consumers consider design as unimportant factor [2]. So design influences on consumers' behavior and facilitates innovation.

Fig.1 – Spray-on dress

Fashion design is the art of application of *design* and aesthetics or natural beauty to clothing and accessories. There are innovations in the following sectors:

• 3D-printing. New York designer Michael Schmidt and architect Francis Bitonti have created a 3D-printed dress for burlesque dancer Dita Von Teese (Figure 2). The dress was designed entirely on the iPad and consists of 17 unique moving pieces that are held together by 3,000 joints—it was also specifically designed to suit Von Teese's body.

• Spray-on fabric. A liquid mixture developed by Imperial College London and a company called Fabrican lets you spray clothes directly onto your body, using aerosol technology. After the spray dries, it creates a thin layer of fabric that can be peeled off, washed and reworn (Figure 1).

• E-textiles (smart clothing). They can be used for health monitoring of vital signs of the wearer such as heart rate, respiration rate, temperature, activity, and posture.

Fig. 2–3D-printed dress

Packaging is designed to capture a customer's attention and it can directly effect whether they buy the product or not. Innovation and creativity come into play when it comes to packaging. A well-marketed product is packaged in a way that compels the customer to pick it up and take a closer look, at which point product descriptions and graphics must be clear (Figure 3).

Fig. 3- Creative juice packaging designs

Examples of innovative packaging:

- edible packaging;
- flexible packaging;
- self-heating / self-cooling packaging;
- heat sensitive color changing coffee cup cover;
- sensor-equipped "smart bottle".

Some companies focus not only on the creativepackaging,but on usinginnovativeadvertising tools and techniques such as 3D-advertising, interactive projection, aholographic screen, a touch screen.

Nowadays design is becoming more and more innovative.Putting an emphasis on design brings creativity into an organization and increases the chance of producing market-leading products. As the sophistication of the consumer and global competition increases, this becomes more and more valuable. Businesses are finding that they can no longer compete just by slashing prices or upping the marketing budget. Innovation in the form of design is the key to success.

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RADAR SURVEILLANCE COUNTERACTION

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The development of radar detection technology has set an engineering task to protect objects from enemy radar surveillance. Modern war conditions require the ability to suppress the enemy air defense system as one of the main tasks of the initial war period. The successful fighting outcome greatly depends on this factor.

The destruction and suppression of the Air Defense is essential in the initial period of hostilities. This was clearly demonstrated by Lugansk Self-Defense Forces in the armed conflict in the east of Ukraine. They destroyed the Ukraine radar station of air defense in the Lugansk region on the 6th May 2014. As a result they broke the control of the air space[1]. Also the war in Iraq and Yugoslavia have shown that if intelligence equipment (radars and radar complexes) and control points are destroyed, it will break operation and centralized management of the unified air defense. These activities reduce the overall effectiveness by 50% or sometimes more.

The goal of our work is to study modern methods of countering radar observations. There are several ways to combat radar observations:

- interference;
- anti-radarcoating;
- direct elimination of the radar;

Interference opposing radar detection can be of different types: active and passive, and masking and simulating.

Interference created to suppress the radar influence is active if they arise from continuous or pulsed radiation transmitters. Interference is created by modifying one or more parameters of the carrier wave. Each radar receiver has parametric selectivity such as the transmission band or polarization.

Passive interferences are formed due to the impact of electromagnetic waves scattered by artificial and natural reflectors. Passive interference is mostly applied to suppress radar observations. Passive interferences include false targets, radar coverage, and others.

Masking interference hides the useful signal and simulating interference imitates non-existent target.

A special false target is proposed to be used as a simulating interference. Remotely Piloted Aircraft Systems (RPAS) is employed for its launch. False targets on RPAS are covered with removable radar absorbing materials. They are removed before the start, thus eliminating the possibility of early detection. Guiding stabilizers with beveled planes are installed at the false target tail. They provide its longitudinal axis rotation to change the flight-in electron paramagnetic resonance.

The passive decoy to simulate a bomber was developed in the USA. The trap- rocket is launched with the bomber B-52. Then it commits the B-52 simulating flight motion. Such a rocket is fitted with guidance and control systems and electronic equipment to make false signals.

The example of false target is shown in Figure 1.

Fig. 1 - Cruise missile trap «Quail»

Continuous noise interferencesare approximately of the same range as the internal receiver noise. Their action is equivalent to the increase of the receiver noise ratio. This similarity of the energy spectra is extremely difficult to protect against noise interference both in pulsed and continuous emission of the suppressed radar. The versatility of this interference is manifested in the fact that they can appear as sighting, targeting and obstruction - barrage.

By changing the site sizes and the reflection coefficient range adifferent frequency range of electromagnetic radiation can be adjusted.

By dividing the surface of the protective coating into multiple areas of different reflection coefficients the effectiveness of the object protection is increased. That provides completeobject invisibility on the of the Earth's background for modern high resolution radar detection.

The model can be used in military equipment as a protective overlapping mask hidingan object beneath it from radar surveillance.

In addition to the devices producinginterferences there is also an anti-radar coating. The function of the coating is to decrease the electron paramagnetic resonance (EPR).Waves falling from space get on the absorbing elements of areas covered and diffusively scatter.

There are two types of anti-radiation cover: 1. absorbing and 2. Interference.

Absorbing coating will convert the electromagnetic waves energy into heat. Neoprene-nylon fabric is mainly used and special ceramics as well. Such coatings are made non-smooth and multi-layered, with increasing on-surface conductivity.

Interference coatings weaken the reflected wave. Thecoating thickness should be equal to the wavelength quarter (waves reflected from the object surface are anti-phase). A mixture of rubber and carbonyl iron and others are used to make such coatings.

Different reflection coefficients of surface areas are used on anti-radar coatings. Because of this, the entire surface is not seen as a whole object. The reflection is not different from the earth background. The operating range of radar electromagnetic wavelengths is almost completely overlapped.

A few years ago at the Moscow Research Institute of Steel a complex of Mantle was developed to counter the radar surveillance. There was used anti-radiation coating. The surface layer was made of camouflage color textile.
The example of anti-radiation coating is shown in Figure 2.

Fig. 2 - Tank T-90MS with a complex of Mantle.

Protection and support of the attack can be carried out by planes and helicopters using smoke screens and the like. However compared to the radar detection, protective armor vehicle capabilities are much less efficient.

To summarize, protection from enemy radar surveillance is imperative in modern warfare. The analysis of current methods to struggle with enemy radars has revealed the urgent necessity to upgrade or develop new antiradar tools.

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FORECASTING OF POWER CONSUMPTION BY NEURONETS

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Duringexploitation of power plants an engineer has to encounter a number of problems related to the quality of production and efficiency of using equipment including the forecasting of power consumption. These days for these purposes mathematical modeling, based on artificial intelligence algorithms as a neuronetis being actively used. A neuronet is a simplified model of the human brain (fig.1)

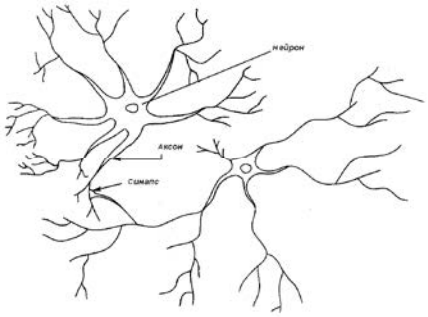

Fig.1- A simplified model of the human brain

The brain consists of neurons which can be represented as individual processors. The neurons are connected to each other by means of nerve endings of two types: synapses, which are used to send a signal to a neuron and axons, which are used by a neuron to passa signal further. Each neuron has about 1000 numbers of such connections, but there are much more connections in the cerebral cortex. The structure of brain is multilayer and has large amount of inner cycles. The brain work with great simplifications can be represented schematically in figure 2. The outer layer of the net sends impulses from the external environment, the middle layer (the cerebral cortex) processes impulses then the output layer produces actions back into the environment.

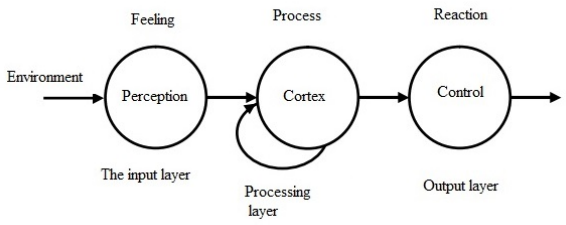

Fig. 2- The multilayer architecture of the brain

In conditions, when a number of industrial enterprises are focused on changeable needs of market and customer demands, modeling and forecasting of power consumption is becoming a difficult task.

Nowadays there are large amount of forecasting methods by using neuronets that differ by the type of using nets and the methods of their training.

That problem can be solved in two ways: by using single-layer neuronets or using the assembly of neuronets.

SINGLE - LAYER NEURONETS

On diagram1 there is a graph of power consumption by the hour on workdays in a winter period. The statistical data of power consumption and results of average temperature in one of the areas in the country from 2011 to 2015 were used as the basic data for prediction.

The main feature of hourly loads of power system is certain repeatability, depending on days of week and month. There are two types of loads, for working days and non-working days.

Let us analyze the changing of energy consumption during a working day.

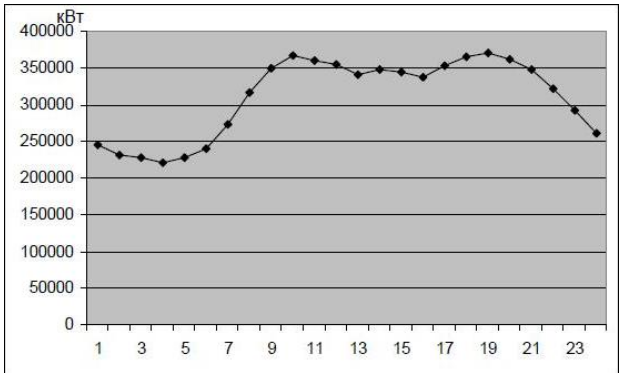

Diagram 1 Hourly consumption electricity in the winter time

The analysis graph shows that working day is divided into three periods: peak, half-peak and minimum. On the graph a minimal level of power consumption corresponds to the period till 6 a.m. and maximum consumption from 9 to 10 p.m.

Analysis of power consumers showed,that industrial consumers make 38.5%, not industrial - 24.7%. It follows from this that sharp fluctuations of power consumption are improbable. However, while processing of data, “failure days” were noticed. They are the days where there is “an error jump” of predicting with further future normalization.

Analysis of the results showed that most of “failure days” relate to uncertain changes of loads because of their irregularity. Thus, to improve the forecasting process and give, thereby, the universality of this method, it’s rational to use the assembly of neuronets.

The assembly of neuronets is a set of interacting neural nets for creating forecasts with multiple variables. Using it eachresults can be predicted separately. Using Assembly of neuronets is a good way to counteraction of retraining nets and improving their ability to generalizing ability.

Thus, for the automation of power consumption prediction with high accuracy it is reasonable to use a complex hybrid neuronets and assembly of neuronets. This method is applicable to a wide range of consumers with different load conditions, and has application prospects in the scale of the regional companies.

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THE PERSONAL SKILLS OF A GREAT PROJECT MANAGER

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We had always discussed project management in the broad sense. Let's research it from the perspective that any type ofproject—industrial assembly line, technology implementation or new luxurious buildings which are operated by the same sets of rules and processes. For this articlewe'll focus on the last type of project and its leader—the construction project manager.

Project managers are a very special breed of people. They are in much demand and will be increasingly so as the need for effective builders continues to soar. Good construction project managers are trained and they are not born. They develop skills through experience and education. They become better project managers each time they successfully deliver a project. They learn new techniques and apply them on their projects. They learn lessons—sometimes the hard way—to be better managers in the future.

All great construction projects require the efforts of countless skilled workers, hundreds of specific tasks, and the leadership of a great construction project manager.However, inexperienced project managers have the potential for greatness, but they must possess five crucial abilities to become a "Great Construction Project Manger."

What Does a Construction Project Manager Do?[1]

They should plan, direct, or coordinate usually through subordinate supervisory of personnel activities concerned with the construction and maintenance of structures, facilities, and systems. They should participate in the conceptual development of a construction project and oversee its organization, scheduling, budgeting, and implementation. Construction project managers should include managers in specialized construction fields such as carpentry or plumbing.

Necessary Skills

There are many and varied skills which a good project manager should possess and covering the entire spectrum of the human personality. We can divide these skills into a number of specific categories:

Personal Skills[2]

Project Managers must be able to motivate and sustain people. Project team members will allow to the project manager to solve problems and help with removing obstacles. Project managers must be able to address and solve problems within the team as well as those that occur outside the team. There are numerous ways, both subtle and direct, in which project managers can help team members. Someexamplesincludethefollowing:

- Manage for example. Team members will be closely watching all actions of the project manager. Therefore, project managers must be honest, direct, straightforward, and knowledgeable in all dealings with people and with the project. A good manager knows how to work hard and have fun, and this approach becomes contagious.
- A positive attitude. Project managers must always have a positive attitude, even when there are substantial difficulties, problems, or project obstacles. Negative attitudes erode confidence, and a downward spiral will follow.
- Define expectations. Managers who manage must clearly define what is expected of team members. It is important to do this in writing—get agreement from the individual team members. This leaves no room for problems later, when someone states "It's

not my job." Performance expectations must be defined at the start of the project.

- Be direct. Project managers are respected if they are direct, open, and deal with all types of problems. Never conceal problems or avoid addressing them. If a problem is bigger than the project manager or the team can deal with, escalate it to senior management. Never make commitments that can not be delivered.

1) Technical Skills

Questions that project managers should ask include the following:

1. What types of problems require management?
2. Who will solve them?
3. Is it done with quality and satisfaction?
4. Who can I rely on in my project team?
5. What outside resources, if any, can I draw on for assistance?

As with all employees, project managers should have the knowledge and skills needed to do their jobs. If managers lack theseskills, training is one option; being mentored or coached by a moreexperienced individual is another. Senior management should ask the question " Do your project managers need more technical skills thanthey already possess?"

On larger complex projects, such as systems integration projects ormultiple-year projects, there are frequently too many complex technologiesfor the project manager to master. The training that providesbreadth may be useful. On smaller projects, the project managermay also be a key contributor. In this case, technical trainingmay enhance the abilities of project managers to contribute technically,but it is unlikely to improve their management skills.One thing is abundantly clear—the project manager is ultimatelyresponsible for the entire management of the project, technical or otherwise,and will require solutions to the different issues that will occur.

While it's possible to work your way up from a construction trade to project manager, it's a good idea to earn a bachelor's degree or certificate in construction management. You'll learn the complexities of the construction industry that you might not come into contact with if you're working as a carpentry foreman, such as estimating, cost control, risk and safety management, and contract administration.

2) Management skills

Project managers need other key skills besides those that are purelypertained to lead and deliver on their projects successfully. A goodproject manager needs to understand many facets of the businessaspect of running a project, so critical skills touch on expertise in theareas of organization, communication, finance, and human resources.The following are examples of the management topics used in trainingeffective project managers:

- Project planning, initiation and organization
- Recruiting people and keeping them
- Effective project negotiation
- Accurate estimating and cost control
- Project execution and control
- Developing powerful project presentations and reports
- Personal and project leadership
- Managing risk and making decisions
- Effective problem management
- Performance management
- Managing the projects within the organization
- Growing and sustaining a high-performance team

3) Coping Skills

A good project manager has to acquire a number of skills to cope with different situations, conflicts, uncertainty, and doubt. This means being:

- flexible
- persistent and firm when necessary
- creative, even when the project does not call for it
- Absorbing large volumes of data from multiple sources
- patient but able to differentiate between patience andaction
- able to handle large amounts of continuous, often unrelentingstress

Additionally, good project managers have high tolerance for surprises,uncertainty, and ambiguity. Projects rarely progress the way that theyare defined, and managers need to manage the uncertainty that comeswith that.

Managing a project and a full team of diverse individuals is not an easy task, but those who prepare accordingly and take the appropriate actions know that doing so will significantly increase the chances of success on a project.

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УДК 694

CANADIAN WOOD-FRAME HOUSE CONSTRUCTION IN SIBERIA

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Siberia is the biggest part of Russia. The Siberian region(and Krasnoyarsk in particular)has huge amount of natural resources here and people who live here. But unfortunately only 25% of people can buy an apartment in Krasnoyarsk city. It means that one of our main aims at the moment is to find solution of this important problem. We could use all our territory to build big houses for people instead of small apartments and all of that is for the cheapest price. This article presents one of the ways to do that.

Timber frame is one of the oldest forms of construction, coming back to the days when homes and other buildings were built out of logs. Today, modern timber frame structures are precision-engineered, strong and durable, although the same basic rules apply. Timber-frame construction use standard, fabricated timber wall panels and floors commonly in use in many developed countries. This modern method of constructing housing and other buildings uses advanced breathable membranes, insulation and vapor control layers along with careful detailing to ensure durability. Building regulation requirements for thermal, acoustic and fire performance are all incorporated into the timber frame design.

One of the most popular new trends in timber-frame construction is Canadian wood-frame house construction.Wood-frame housing may be built to various designs and specifications. Whether a standard design is used or a custom design is created, building code provisions and good design principles must be observed to provide a durable house; to maximize occupant health, comfort and safety; and to reduce a building's environmental footprint.

Fig.1 Canadian wood-frame house construction

So, what is the structure of such houses(Fig.1)? The basis of a building is balloon framing. It is made of wood and then filled in by the insulation. The high speed of building is provided on using prepared frame panels.

If we look at the structural design, we can notice provisions for bracing to resist lateral loads from earthquakes and high winds. And we need to consider this fact if we talk about our Siberian conditions, because there are both the first and the second natural conditions in Krasnoyarsk. The provisions are based on a three-level risk-based approach developed from environmental load data.Wood-frame construction is considered to provide an acceptable level of fire safety, dependent to a degree on gypsum board finishes, which provide essential fire protection of structural components for a certain period of time.

In the 21st century we pay special attention to our ecology. Krasnoyarsk region is in the list of ten most polluted cities in Russia that is why we especially interested in environmentally friendly home and conservation of our environment generally. As we know,wood is one of the few natural building materials. It has many advantages. It is not toxic, does not leak chemical vapor into the building and is safe to handle and touch. It also means that as timber ages, it doesn't break down into environmentally damaging materials. And therefore timber-frame construction is also one of the ways to escape huge pollution of low-rise buildings.

There are really hard conditions in Siberia and that is why we need to consider all nature features and differences from other parts of our country. Almost all features of Canadian nature at all are similar to our Siberian conditions and that is why we need to pay our attention to their construction technology. Canadian wood frame house construction has been getting used to our country recently. We can find a building company which will care about all important things without any problems. And also we can build this house ourselves with necessary types of knowledge and skills of course.

This method was created after the II World War. At that moment Canada had big amount of refugees and that is why they had to invent new inexpensive method of construction.Nowadays our country has low availability of housing but Canadian method has cheap price and quite easy construction technology. And, that is why I think this method is one of the ways to solve housing problems in Krasnoyarsk.

I would like to make a comparisonin the conclusion. The cost of anapartment in Krasnoyarsk is 54 thousand rublesper square meter. And the final cost of a timber-frame house is 20 thousand rublesper square meter. Canadian method offers high speed of construction and as we can see, it is much cheaper in comparison with apartment house. We can use this construction technology not only in Krasnoyarsk but also all over our region. It means that due to new construction method we can increase population density of the Krasnoyarsk region.And all these factslet me justify the utility of this method in our Siberian conditions.

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УДК 644.48

ARE WE READY TO TAKE THE BATTLE? PEOPLE VERSUS GARBAGE

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Annually Krasnoyarsk residents make approximately 400.000 tons of solid domestic waste. Only a third is recycled, whereas the rest is buried at dumpsites. The regional government has to finance the construction of new dumpsites that will waste hectares of clean fertile ground. Moreover dumpsites contaminate air, water and soil with pathogenic and unnatural substances.

A way to sort out the problem is recycling. It is more advantageous than the thermal treatment. However it also implies some challenges to overcome for both the government and Krasnoyarsk residents. The object of the work is study the solid garbage sorting process and how it is currently realized in Krasnoyarsk. The following tasks were set: 1. what the solid waste and the process of its sorting and recycling is; 2. foreign experience and the actualities of solid waste sorting in Krasnoyarsk; 3. implementation of the solid garbage sorting program in Krasnoyarsk and Krasnoyarsk krai.

Solid domestic wastes are solid things and goods that have lost their consumer qualities. Solid wastes (SW) areseparatedintobiologicalsolidwastesandnon-biologicaldomesticwastes(natural or artificial ones). Waste recycling is aprocess to treat waste physically, thermally, chemically in order to prepare them for the final conversion. The current industry development allows recycling of many materials such as glass, paper, aluminum, iron, bitumen, tissues, different kinds of plastics, organic wastes. Recycling must be preceded by a sorting operation including two steps. The first is domestic garbage sorting into different packets by common residents. The second step takes place at a recycling enterprise.

Garbage sorting system has long been practiced in developed countries. In Russia there are some non-regular garbage sorting and recycling initiatives realized in a handful of cities. In Krasnoyarsk, in particular, there are few containers to collect some kinds of garbage like paper or plastic located by some private companies working in garbage recycling business. Businessmen choose places for container sand run encouraging campaigns thus organizing the raw material supply for the business. For instance, two years ago there was a popular action «Let's swap: candies to packets!». Also containers for various wastes have been placed at the Krasnoyarsk railway station for more than a year. 300 m^3 of domestic wastes are taken out every month. Similar containers are put at railway stations of all Russian regional capitals according to the federal railway program. In2012 the first solid waste recycling plant started in the Altai republic. Its annual capacity accounts for 32.500tons. Krasnoyarsk followed the example. A garbage-sorting plant has been built and recycles 730.000 tons of domestic wastes a year. Specific modern equipment is employed to sort glass, paper, plastic and metal things out of the whole garbage mass. The garbage that can't be recycled is buried at specially-organized dumpsites. The sorted garbage is toughly pressed and packed ready to be further recycled. Start in garbage recycling plant is the first step to the civilized solid waste treatment, and thus to improving the city ecology. The next step should be constructing two plants: one of waste recycling and that of thermal waste recycling to treat non-sorted wastes to obtain power resources or dross suitable to be used in an industry (heat insulation material, dry mixtures, and others). The rare similar plants in Russia. However, currently the operation mechanism between the madhouse servicing companies has not been

regulated. The cheapest way to treat garbage for the latter is to stock or bury it rather than promote sorting campaigns among population and be involved on garbage sorting.

A reason of low recycling coefficient is the lack of garbage sorting at the first step. That means, it gets mixed at the recycling companies. Russian residents do not have the habit to distribute the garbage. A survey was conducted among residents of different ages, occupations and economic welfare. They were asked about their attitude to garbage sorting and reasons that cause refusal/unwillingness to do it one and also about possible solutions. As a result, there was revealed 75% of respondents don't sort their garbage at all. 25% do it sometimes. This percentage can be explained by the fact that currently the complete garbage sorting does not make sense because the city isn't equipped with special garbage containers. Citizens also answered the questions about battery and wastepaper recycling.

This percentage can be explained by the fact that currently the complete garbage sorting does not make sense. Only the fourth part of respondents brings the run-out batteries to the special center. This happens due to the fact that people just do not know where these special centers are located. A similar situation is with wastepaper. The majority of therespondents simply do not know where to bring waste paper and batteries.

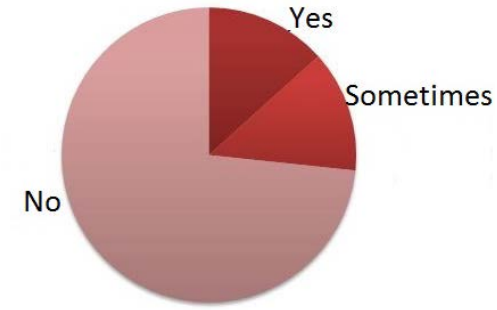

Fig. 1. «Do you deliver the used batteries to special collection centers? »

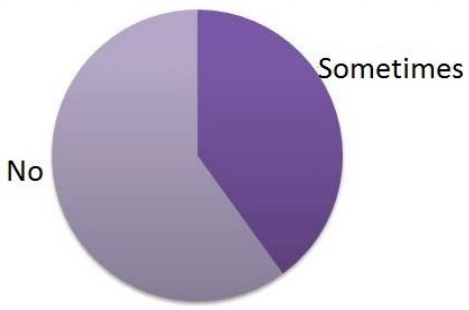

Fig. 2. «Do you collect waste paper? »

We believe that every citizen must know what to do with expired batteries and energy-saving lamps, overdue medicines, and others. Information about the centers must be as accessible as possible. For example, it can be written in the monthly payment bills. Also, the residents of our city are not accustomed to put paper or plastic in different sections. But it is only a matter of time and purposeful work. In Europe, it took about 15 years, but now the results are obvious. Everywhere there are multi-colored garbage containers used by the population.

The questions «If in Krasnoyarsk instead of the usual garbage containers there were new, specialized multi-colored containers with images of what you can throw there, would you sort garbage?» and «If in our city a system to sort the garbage started, and the pay for house utility services was half less (as it is customary in Europe), would that encourage you?» were answered the following way: 98% of respondents completely agreed. And the most popular answers to the question: «What is the most effective way to attract public attention to the problem of sorting the garbage?» are various bonuses, promotions and advertising, reception centers located in a close proximity to the home. Consequently, the residents of Krasnoyarsk are ready to participate in the sorting of waste, if all the necessary conditions are created for this.

To conclude, it has been revealed that a very small amount of solid waste is sorted and recycled in Krasnoyarsk these days. It is implemented only by some large enterprises, which are obliged to sort the garbage, or private companies that are involved in garbage business. In our region and in the city there isn't a program for large-scale solid waste sorting and recycling. Also it was found out that the majority of citizens is ready to respond to

environmental initiatives. However, such initiatives should not be a single action, but regular well-thought tools: designing regional/city maps showing all the centers to collect solid waste (address, phone, schedule, reception conditions, etc.); popularization (social advertising in streets, Internet and TV advertising, various city, regional, national or international actions, the Earth Day, for example); development of local enterprises to recycle garbage and subsidizing small companies working in the field; installation and servicing specialized bins and containers. This is an incomplete list of the possible measures.

The garbage problem can be solved only if both the government and local residents will cooperate.

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HYBRID ENGINE AS ECOFRIENDLY ALTERNATIVE TO INTERNAL COMBUSTION ENGINE

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At the present time the question about environmental conservation appears more than even. More and more people are making urgent actions to prevent the ecological crisis. One should note that transport is one of the most dangerous environmental polluter. Combustion products pollute the environment and the exploitation of resources is causing environmental depletion. It is impossible to avoid completely the use of private cars; in addition, the mass scale use of electric cars is hampered by lack of battery charging stations. The possible solution to the problem is to apply the hybrid engine. According to Curtis Darrel Anderson and Judy Anderson's book, hybrid engines allow reducing fuel consumption by 20-30% and emitting into the atmosphere less substance.

Lochner-Porsche was the first car with hybrid engine. It was developed by Ferdinand Porsche in 1900. Different companies have manufactured hybrid cars and hybrid trucks. However, people did not pay much attention to ecological problems in those days.So in case of some problems, such a high cost and low power, hybrid engines were not produced in large quantities [1].

Any vehicle that uses two or more distinct types of power, such as internal combustion engine and electric motor can be rated as hybrid. The hybrid vehiclecombines the gasoline engine with an electric motor. These vehicles are innovative as well as customizable in that the design can be configured for different purposes. Improved fuel economy, added auxiliary power, and increased horse power are some of the possible configurations. Hybrid electric designs are made up of a gasoline engine, a fuel tank, an electric motor, a generator, batteries and a transmission. The electric motor, generator and batteries all work on behalf of the hybrid concept. Motors not only help power the car, but can also act as generators; therefore they can draw energy from the batteries, as well as return energy back to the batteries. The generator itself works solely to produce electrical power, while the batteries are where energy for the electric motor is stored [2].

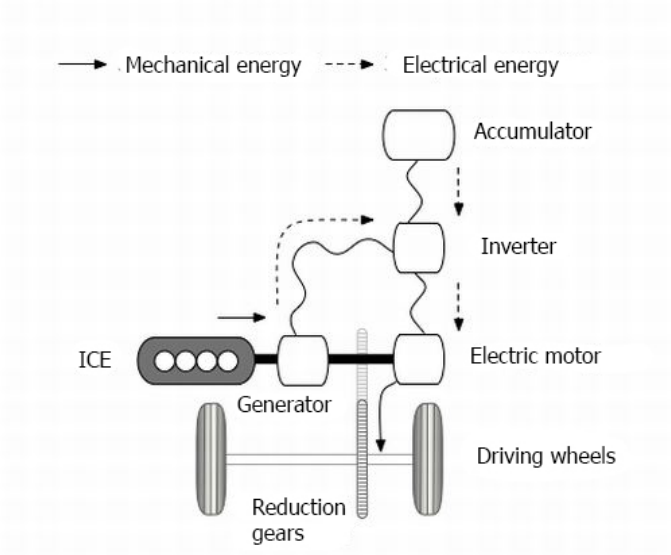

Fig.1– Series architecture

The vehicle is configured to use each power source as appropriate to maximize performance and/or fuel efficiency. Depending upon the configuration of these power sources, a vehicle may be defined as a series or parallel vehicle.The three main classes of hydraulic hybrid architectures are series, parallel and hydro-mechanical (HMT) or power-split.

Series hybrid (Figure 1) is the simplest option of hybrid engine. A series hybrid has two power sources linked together in a series, meaning that the output of the first power source feeds into the input of the second, and there is only one power source directly connected to the vehicle's transmission. The gasoline engine turns a generator, and the generator can either charge the batteries or power an electric motor that drives transmission [4]. The series hybrid allows both the gasoline engine and electric motor to run at their most efficient setting, maximizing its performance and efficiency of the vehicle.

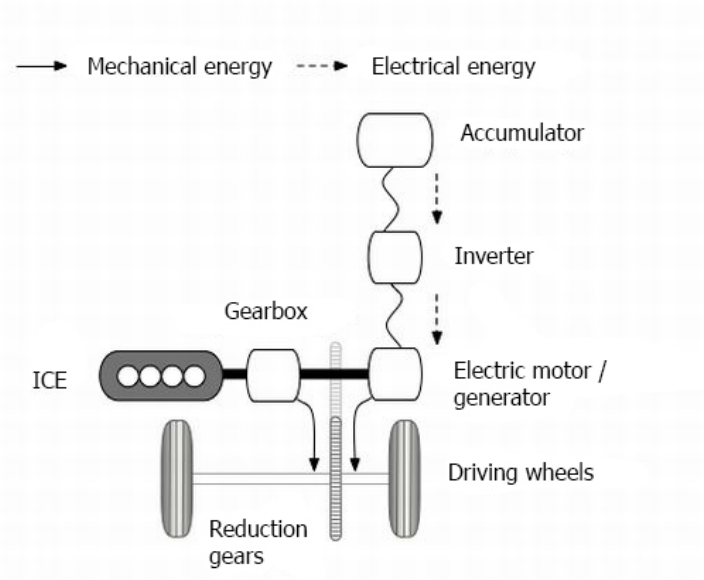

Fig.2 – Parallel architecture

Parallel hybrid uses internal combustion engine(ICE) and electromotor (Figure 2). In this case electromotor must be able to operating as a generator. A parallel hybrid has two power sources connected, through the transmission, to the drive wheels. Each power source may supply some or all of the power needed by the vehicle at any particular moment. Common examples of parallel hybrids are vehicles in which both a gasoline engine and an electric motor connect to the same transmission. In this design, the amount of power supplied by each source is dependent upon the vehicle requirements at that point. As an example, when accelerating from a start, the parallel hybrid may use both power sources, switching to just one under less demanding highway cruising [4].

Hydro-mechanical transmission (HMT) uses a pair of hydraulic pump/motors and a planetary gear set [5]. It allows aportion of power to be transmitted mechanically and theengine to operate at arbitrary operating points. They incorporate power-split devices allowing for power paths from the engine to the wheels that can be either mechanical or electrical. The main principle behind this system is the decoupling of the power supplied by the engine (or other primary source) from the power demanded by the driver (Figure 3).

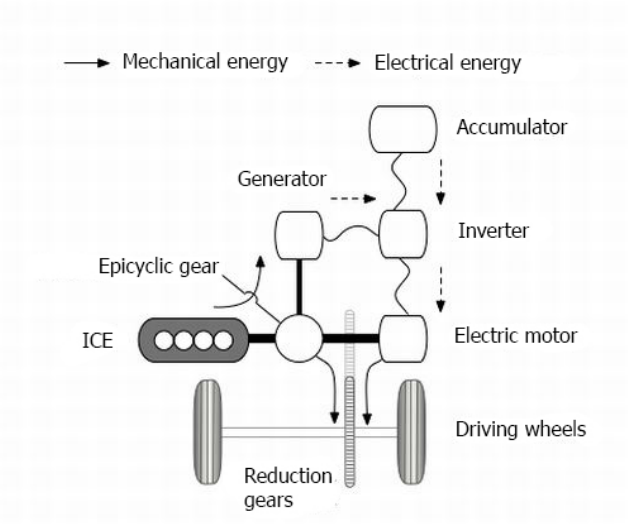

Fig. 3. HMT architecture (Power split)

Doubtless advantages of hybrid cars include the following:

- they run cleaner and have better gas mileage which makes it environmentally friendly. A hybrid vehicle runs on twin powered engine that cuts fuel consumption and conserves energy;
- Because less gasoline is burned in these vehicles, there is less pollution causing emissions released into the atmosphere.
- lower annual tax bills and exemption from congestion charges comes in the form of less amount of money spent on the fuel(in some countries).

On the other hand, hybrid cars have some disadvantages:

- the retail price is quite expensive in Russia;
- higher maintenance costs;
- necessity of battery replacement in 6-7 years and high cost of battery;
- absence of the secondary market of hybrids in Russia.

Based on the foregoing research we can make conclusion that the hybrid cars do less harm to the Earth's environment. Car owners should understand, that hybrid engine can help us to prevent the ecological crises. Because less gasoline is burned in these vehicles, there is less pollution causing emissions released into the atmosphere. In addition, there is a lower level of carbon dioxide released into the atmosphere. The automobile manufacturers are always looking for ways to increase the energy efficiency. They have continuously used the latest technology to increase the fuel economy, safety features and the performance and comfort of vehicles.

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UDK 621.391.25

QUASI-OPTIMAL SEARCH ALGORITHM FOR TWO-COMPONENT SPREAD SPECTRUM SIGNAL WITH MSK-BOC MODULATION

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In this paper[1], we investigate the parallel search algorithm of two-component quasi-periodic minimum shift keying-binary offset carrier modulated spread spectrum signals.

The received MSK-signal represented as [1]

$$s(t)=\sqrt{2P_s}[I(t-\tau_s)\cos(\omega_0 t+\varphi_0)-D(t-\tau_s)Q(t-\tau_s)\sin(\omega_0 t+\varphi_0)], \quad (1)$$

$$I(t)=\sum_{j=0}^{L-1} d_j \sum_{k=0}^{N-1} c_k I_0(t-kT-jT_{PRS}),\ Q(t)=\sum_{j=0}^{L-1} d_j \sum_{k=0}^{N-1} s_k Q_0(t-kT-T/4-jT_{PRS}), \quad (2)$$

$$I_0(t)=\begin{cases}-\sin\left(\dfrac{2\pi t}{T}\right), & |t|\le T/2;\\ 0, & |t|>T/2,\end{cases} \qquad Q_0(t)=\begin{cases}\left|\sin\left(\dfrac{2\pi t}{T}\right)\right|, & |t|\le T/2;\\ 0, & |t|>T/2,\end{cases} \quad (3)$$

where P_s is signal strength; ω_0 is carrier frequency; φ is initial phase; τ_s is time delay; $I(t)$ and $Q(t)$ are real and imaginary components of the complex envelope with elements represented as(3); $\{c_k\}$ and $\{s_k\}$ are periodic pseudo-random sequences (PRS) of length N; $D(t)$ is a binary data signal. Length of the data bit equal to duration $T_c = LT_{PRS}$; T_{PRS} =2$NT$is a PRS period; L is the number of multiple of four code periods; $\{d_j\}$=(1, 1, 1, –1, …)is the periodic orthogonal code of length 4.

According to (1)-(3) signal is a set of L signals periods repeated at an interval of T_c. The pilot-component $I_0(t)$ has *MSK-BOC*(2) modultaion, data component $Q_0(t)$ has *MSK*(2) modulation. In parentheses indicated the number of the sine chips duration of T/2 number per PRS element: alternating-sign chip for *MSK-BOC*(2) and constant-sign chip for *MSK*(2).[1]

Optimal searching process which provides the minimum seek time is based on parallel analysis of all the points of the area in purpose to detect the maximum of cross-correlation function of the received and reference signals. The number of analysis points is M, it defines the number of quadrature correlators pairs that must be employed to perform the search. Implementation of optimal search algorithm for the large length N of the code sequence is associated with considerable hardware and computational cost [2,3]. Maximum simplification of parallel search algorithm is possible due to approximation of the reference video quadrature signals by sign functions [4,5].

Reducing the number of channels is achieved by increasing the search step, the maximum value of which is equal to half duration of T/2 sine chip (Fig. 1). When viewing a step T/4 cell number search is $M = 4T_s/T$. Reduced computational cost is achieved at the expense of splitting into two search procedures: the searching signal by delay interval $[0, T_{PRS}]$ and elimination of uncertainty of multiple of T_{PRS}(frame alignment). In this case reference PN signal is a strictly periodic signal with period T_{PRS}. The number of search cells

[1]*Работа выполнена при поддержке РФФИ (проект № 16-38-00171)*

are $4N = 4T_{PRS}/T$ and $K = (T_c + T_s)/T_{\text{п}}$ for the first and second search procedures, respectively.

The structure of quasi-optimal search algorithm is determined by the following operations. During each cycle performed element wise quadrature components processing of the received signal at intervals equal to a quarter of duration of the PRS element. On the basis of these results calculated in-phase and quadrature correlation separately for received and data components of K periods of each cycle:

$$u_{1jl} = \sum_{k=0}^{4N-1} X_{j,k+l} C_k,\ w_{1jl} = \sum_{k=0}^{4N-1} Y_{j,k+l} S_k,$$

$$u_{2jl} = \sum_{k=0}^{4N-1} Y_{j,k+l} C_k,\ \ w_{2jl} = \sum_{k=0}^{4N-1} X_{j,k+l} S_k, \qquad (4)$$

where $C_k = (-1)^k c(t_k)$ and $S_k = s(t_k)$ are the samples of quadrature PNS in increments of $\Delta t = T/4$; $l = 0, 1, \ldots, 4N-1$ is the search cell number.

In-phase and quadrature correlation for the received and data signal components are combined according to the algorithm:

$$z_{1l}(r) = u_{1l}(r) - \hat{D}_l(r) w_{1l}(r),$$
$$z_{2l}(r) = u_{2l}(r) + \hat{D}_l(r) w_{2l}(r), \qquad (5)$$

where

$$\hat{D}_l(r) = \text{sign}[w_{1l}(r)u_{1l}(r) + w_{2l}(r)u_{2l}(r)]. \qquad (6)$$

According to (5) is performed removal of the inverted modulation from in-phase and quadrature correlations of the information component. For this purpose used information symbol estimation (6), this is formed on the basis of the results of coherent accumulation quadrature components.

Simplification of the search algorithm is achieved by replacing the optimal process algorithm by incoherent accumulation. In this case, the algorithm (4)–(8) is complemented by total correlation modules algorithm of the cycles for each of the K integral strobe shifts in each $4N$search channels:

$$Z_{li}(r) = \sqrt{z_{1li}^2(r) + z_{2li}^2(r)},$$
$$Z_l(r) = \sum_{i=1}^{n} Z_{li}(r). \qquad (7)$$

The summing over i (n values) in (7) is performed for every r-thstrobe shift of l-thsearch channel.

The decision to delay the signal is made by the maximum value of the CCF:

$$Z_{\max} = \max_{l,r} Z_l(r), \quad l = 0, 1, \ldots, 4N-1; \quad r = 0, 1, \ldots, K-1. \qquad (8)$$

The maximum of $Z_{\max}$ is determined for all search channels (code synchronization) and all values of the integral strobe shifts (frame synchronization).

The values of l and r, which provides extreme value(8), determine the reference SRP synchronous channel (fine and coarse values, respectively) delay:

$$\hat{\tau}_s = m_1 T + m_2 T_{PRS},$$

Where m_1 and m_2 are the parameter values k and r respective reference SRP delay of synchronous channel.

Search time for reviewed procedure the minimum possible and equal $t_{search} = nT_c$, where n is a number of non-coherent sum able obtained in each cycle integration results. Thus, when n=10and the length of cycle time is $T_c = 0.5$ s, the search time is $t_{search} = 5$ s.

Suggested algorithm with a slight loss in immunity (0.9 dB) provides significant implementation advantages in compare with optimal algorithm and allows reducing hardware rate requirements due to elimination of multiplications.

The possibility of implementation in real-time mode is determined by required volume of RAM: 2($K \times 4N$) КБКВ (when the volume of a single cell memory 2 KB); and by computing capabilities: required computation volume is determined in the first approximation by number of sum operations $(4N)^2$.

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УДК 623

MODERN TYPES OF MILITARY CAMOUFLAGE

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Nowadays in a modern army new discoveries and modernization are coming into service every day: new guns, new chemical and biological weapon, rockets, tanks, airplanes and others. They must be not only created without any defects and delivered with extreme caution to appointed place, but also there should be special place to deploy them. Of course, vehicles of large size for example, boats, tanks, planes need to be masked before using. This paper considers military camouflage of armament, vehicles and personnel.

The development of military camouflage was driven by the increasing range and accuracy of infantry firearms in the 19th century. In particular, the replacement of the inaccurate musket with weapons such as the Baker rifle made personal concealment in a battle essential. Two Napoleonic War skirmishing units of the British Army, the 95th Rifle Regiment and the 60th Rifle Regiment were the first to adopt camouflage in the form of a rifle green jacket, while the Line regiments continued to wear scarlet tunics.

At the end of 60s, military camouflage was adopted by civilians who wanted to attract attention and to feel themselves as soldiers. After this military camouflage have been actively used and upgraded in all armies in the world [1, p.20].

Fashion came back at the end of 80s in more soft textiles and insignia began to be used. Not only people were masked, but it was also important to mask military vehicles, large guns, military houses and other facilities.

There are three visible colors of nature: winter, desert and green (also named “pixel” or “digital”). Camouflage is applied more often on snipers, few intelligence tanks, artillery and so on. But there are special types of masking, which are used in the field of electronic warfare, called radar camouflage.

Electronic warfare or EW is any action involving the use of the electromagnetic spectrum or directed energy to control the spectrum, attack of an enemy, or impede enemy assaults via the spectrum. The purpose of electronic warfare is to deny the opponent the advantage of, and ensure friendly unimpeded access to the EM spectrum. Radio location stations are masked not so well like tanks, but they are having disguise too. This station do not participate near another types of army, they are stationed about five hundred kilometers away because their electronic waves work at long distance. They are usually masked by nature, for example, tree leaves, if the nature is green; some sort of desert camouflage, if the nature is saharian; or snow in winter time [2].

Nowadays, no one battle action does not start without radar intelligence, because the enemy can easily prepare for battle, placing its troops in ambush, which cannot be detected with the naked eye. Usually, the first step in a combat mission is to find and destroy enemy radar stations, thus helping to Special Forces.

In comparison with infantry, radar stations have an invisible defend, which prevent them from breaking another radar enemy station to steal some information. That is why every radar station is equipped with special radio-electronic barrier, which defend station from hostile radio waves. Armies of many countries like Russia, USA etc. work on this principle.

For example, in 1962 people created the first stealth airplane to conduct aerial reconnaissance for hostile air defense safely. Stealth technology is a sub-discipline of military tactics and passive electronic countermeasures, which covers a range of techniques used with personnel, aircraft, ships, submarines, missiles and satellites to make them less visible (ideally invisible) to radar, infrared, sonar and other detection methods. It corresponds

to military camouflage for these parts of the electromagnetic spectrum (Multi-spectral camouflage) [3].

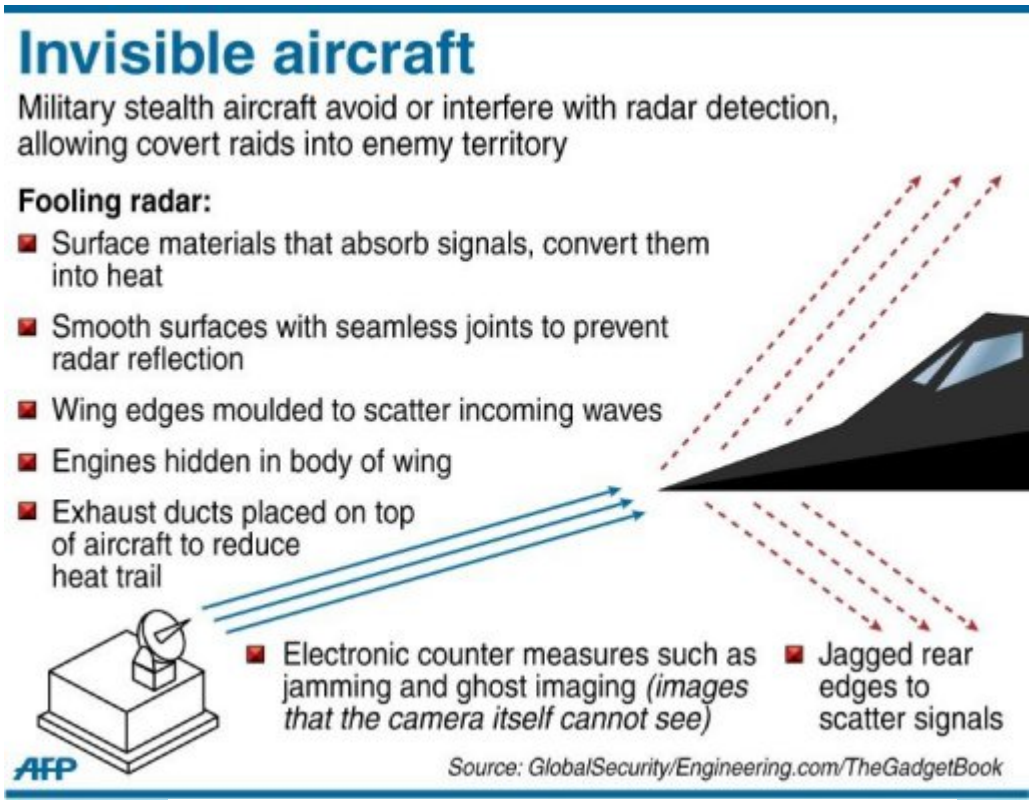

Fig.1- The principles of STEALTH radar defense operating

Russian army has a lot of radar stations on its borders to detect hostile targets. Some of these radars also have anti-aircraft artillery to destroy rockets, planes, air intelligence and they provide immediate full information about aircraft characteristics (size, type, purpose, crew and even threat level).

Current modernization and development are aimed at new types of masking both visible and invisible, being tested in field conditions. For example, there are few camouflages which not only mask the vehicles, but can also blind hostile fighter and even create smokescreen which can completely hide the vehicle in the smoke that will allow it to change its position. Some tanks have special camouflage thermal protection which can hide vehicle from detection in cold places.

Today, military field is one of the most developing spheres. It is financed by governments of different countries as well as by international organizations, because, unfortunately, today world is full of conflicts and tensions. In terms of technical modernization the basic direction of development are connected with invisibility, for example, STEALTH airplanes, special combat clothing which can absolutely blend into surroundings, new kinds of military camouflages, etc.

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IMPROVING THE EFFICIENCY OF ZHELEZNOGORSK TECHNOPARK

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Every year the number of technoparks in the world is growing rapidly. Now there are more than 3000. 43% of them are in the US, 34% in EU, 11% in China and 13% in other countries. Russia, unfortunately, is part of the 13%. By 2014 Russia had over 200 parks, in 2015 their number was 179[1]**.** Moreover, very soon about half could reduce this figure. The reason is "significantly reduced the number of organizations that call themselves technology parks" [1].

Five years ago[2], in 2011, a new technopark in the sphere of high technologies was opent in Zheleznogorsk of Krasnoyarsk territory. It was assumed that the focus of the technology park would be on the nuclear and space technologies, although would develop other sectors: petrochemicals, engineering, instrumentation, biotechnology. However, until 2015, the technopark did not work to its full capacity and the cost of its creation was not compensated. Our purpose is to study the literature and practical experience of existing parks, with a view of making recommendations for improving the effectiveness of Zheleznogorsk technopark.

Despite the fact that technoparks on the territory of Russia exist more than half a century, there are still no well-established definitions and classifications. After reviewing the literature, we adhere to the international definition:

“Technological Park (hereinafter-technopark) is an organization managed by professionals whose main goal is to increase the wealth of the local community by promoting a culture of innovation and competitiveness of innovative businesses and research organizations. To achieve these goals, a technology park stimulates and manages the flow of knowledge and technology between universities, research institutes, companies and markets. Technopark facilitates the creation and growth of innovative companies through incubation processes and launch new companies from existing ones (spin-off processes). Technopark besides high-quality space provides other services”[1].

The main purposes of creation of technoparks are [2]:

- Acceleration of local and regional development;
- Involvement of local firms and organizations;
- Creation of additional workplaces, (which would solve the problem of employment in the region, in particular the Krasnoyarsk territory).

Our research shows that most of the parks are located in the cities, but they are not large in number of workplaces, as well as the same size conventional business center. Mainly in the best case, management staff includes 10 people. Almost 50 per cent of technoparks are located in the territory with higher educational institutions. There is a business incubator in each technopark.

The choice of performance criterion is equally important to the effective operation of technopark. Discrepancies are observed among researchers and practitioners. Some scientists consider the main purpose of technoparks as the introduction of innovations into the market; others recognize them as the opportunity and the need to increase the number of workplaces. The third group of scientists considers commercialization of patents and licenses as the main criterion while others pay attention to evaluation of technoparks in the media. Different approaches to the criterion of activity of technopark areshown in table 1.

Table 1. Criteria of business parks.

Performance criteria of business parks	
In foreign practice	The creation of new jobs
In Russia:	
17% technoparks	The number of new companies
16% technoparks	The number of companies involved in the technopark
6% technoparks	Patents and licenses commercialization
6% technoparks	Evaluation in the media

According to this table the majority of the parks focus on recruiting new companies and increasing the number involved in the technopark, but there are also organizations that have chosen its focus on patents and licenses commercialization. In foreign practice, the number of new jobs was selected as the criterion of parks.

For successful operation of technoparks, we spotted a number of conditions that determine their success:

- the presence of universities, research institutes with high research and technological potential;
- developed research and production and marketing infrastructure, availability of equipped laboratories and facilities for pilot productions, comfortable offices for scientific staff and technical staff;
- extensive and reliable transport and communication systems, including unlimited and free access to the Internet;
- the necessary housing and utilities, cultural, health and other infrastructure;
- creation of a business incubator.

Taking everything into account we should notice that technopark acts as a "wrapper", which allows developing intellectual activity and limiting the effectiveness of research and scientific and technical developments.

To improve the efficiency of Zheleznogorsk technopark, we recommend:

- to choose patents and licensescommercialization as a criterion of efficiency;
- to create favorable conditions for developers of innovations in various spheres of activity;
- to strengthen cooperation with the Siberian Federal University and Krasnoyarsk scientific center of the Russian Academy of Sciences;
-creation of a business incubator and/or closer cooperation with KRITBI.

As a result, the main objectiveof technopark is not to obtain budgetary funds but to attract funds from non-state sources. In conclusion, these suggestions can improve the efficiency of Zheleznogorsk technopark.

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THE ARCHITECTURAL APPEARANCE OF KRASNOYARSK

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Nowadays the size of Krasnoyarsk expands because of intensive building development the cause of which is population increase who needs flats or houses. Designers and contractors should make sure that new structures which are going to appear in our city will not deface its general appearance. For this reason it is necessary to know and understand what building constructions of Krasnoyarsk consist.

Krasnoyarsk is a huge city with a large number of various constructions and buildings the view of which has been formed under the effects of historical processes not only in our city but in Russia as whole. It is separated into seven districts which have their own architectural appearance. There you can see constructions of different styles: from classicism and gothic to modern.

What type of buildings is predominant? Structures made of bricks, concrete panels or wooden houses? Does Krasnoyarsk have aesthetic architecture?

In general many people rarely think about these questions. Certainly, there are many things we should pay attention to except the architectural appearance.

In all conscience, it is hard to tell what type of buildings prevails in our city because in each district predominant types vary. For example, the Central District mostly filled with low brick buildings usually covered with plaster. Most of them have four-five storeys but higher structures also can be seen. One of these high buildings is KATEK which has twenty eight storeys, but it does not work yet. At the same time Zheleznodorozhny and Oktyabrsky districts are built up of panel constructions of the 111-97 series which have about nine-ten floors and divided into two types: built until the end of 1990th (fig. 1) and built after 2000th (fig. 2).

fig.1 - 111-97 until the end of 1990th

fig. 2 - 111-97 after 2000th

There are a lot of constructions of types named “Khrushchyovka” (fig. 3) and “Stalinka” (fig. 4) in Krasnoyarsk. They can be seen in every district as construction work mostly took place at periods from 1940s to 1960s when Stalin and Khrushchev governed the country. They might be covered with plaster or other external surface coverings. It is considered that covered buildings of those types look more appealing and lively than original ones.

fig. 3 - Khrushchyovka

fig. 4 - Stalinka

One more very important and prevalent type of building constructions is dwelling. This type is becoming very demanded by citizens who want have their own space for living without any neighbors above and below far away from the city centre with its heavy traffic and exhaust. These built houses usually form especial micro districts on the periphery of the city. For instance, micro districts Udachny, Gorny, Sosny, Serebryany bor, Ovinny and others. These housing can be made from different materials, most popular are bricks, wood and cinder blocks. Apart from these new dwellings there are also plenty of old houses which were built many years ago. Some of them older than fifty years and do not look well as they have not been repaired for a long time. They might be seen in such micro districts as Nikolaevka, Taimyr, Botanicheskiy, Bugach etc.

In addition to this, there are architectural monuments in Krasnoyarsk which are mostly concentrated in the city centre. About 100 houses in Krasnoyarsk have status of objects of cultural heritage now. This status is given to such structures as: the men's gymnasium, girl's gymnasium, Pharmacy of Medical Association, the city hospital and many others. Despite the fact that these constructions are renovated periodically, the original appearance of some of them was lost because of the reconstructions which were done with the transformation of a plan of a house or using too much plaster and large diversity of colors which absolutely change the facture of buildings. The example of such inaccurate restoration is the house of Krutovsky. Changes of this house are shown in figure 5. Now it has a new roof, a new mansard on the right flank and the left terrace is closed.

fig. 5 - the house of Krutovsky

Furthermore, the architectural problem consists not only of improper renovation but also of those structures which building was not completed and those which are partly destroyed and are not going to be reconstructed. These constructions include plants, cultural and entertainment complexes: a part of the Institute of Physics in Akademgorodok, KRASFARMA shops, Krasnoyarsk Pulp and Paper Mill, the "Stroitel" cinema and many other constructions.

To sum up, Krasnoyarsk is a diversified city where the modern is close to old, wooden buildings border panels and brick-made structures. The city where everyone can find the place which is very close to his soul whether it is a new modern structure or some old pretty house.

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ORGANIC ARCHITECTURE

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Organic Architecture - for the first time formulated by Louis Sullivan on the basis of evolutionary biology in the 1890s, and which found fullest expression in the writings of his follower of Frank Lloyd Wright in the 1920s - 1950s.

Louis Sullivan's slogan "form follows function" became the mantra of modern architecture. Wright changed this phrase to "form and function are one," claiming Nature as the ultimate model.

Although the word “organic” usually refers to something that bears the characteristics of plants or animals, in the architecture, it takes on new meaning. Organic Architecture does not copy nature, and rethinking the principles of nature to create a more natural forms, which will be in harmony with the area around them. Wright held that a building should be intimately connected to a particular venue.

The main concept of organic architecture - it is harmony with the environment. Buildings do not try to stand out, but on the contrary, trying to blend with the environment, to dissolve it. It gives people a sense of unity with nature, which is so lacking in the residents of towns and cities. City dwellers, tired from the constant noise and traffic, find solace in such buildings, symbolizing harmony with nature.

The organic architecture define the forms , based on not geometry. They are dynamic, irregular, arising as a result of contact with reality. However, every form of organic architecture to be seen as an organism that develops in accordance with the law of its own existence, in harmony with its functions and its surroundings, like a plant or other living organisms. Organic architecture It uses natural materials, specific to a given area and combines them with the environment. This architecture often incorporates natural elements such as light, plants, and water

Wright suggested to draw a line under the tradition of separation of the building and its components from the surrounding world. In his opinion, the shape of the building should flow from its specific purpose and the unique conditions of the environment in which it is raised. In practical terms, Wright designed the house served as a natural extension of the natural environment.

Wright was interested in the relationship between buildings and their environments. Building should function like a cohesive organism, where each part of the design relates to the whole.

Inspired by the ideas of Lloyd's architects created a modern construction that sheds light on the future.

1. Hypnotic Bridges

The impressive, undulating design, destined to function as a pedestrian footbridge over the Dragon King Harbour River in China.. The bridge design involves three individual, swirling lanes hovering over the picturesque landscape of Changsha.

2. Rotating Skyscrapers

Architect Dr. David Fisher, Founder of Dynamic Architecture has envisaged a slightly different future for the construction industry in Dubai. Latest innovation, known simply as 'Dynamic Tower', is a 80 floor, 420 metres high skyscraper, which is capable of generatingit's own electricity via the output of 48 wind turbines mounted between each floor level. Only concern would be how loud these wind turbines actually are, as the ferocious desert winds flow through the building.

3. Indoor Parks

This the project offers particularly stunning design based on a theory of "Wild Urbanism. The park will feature four landscape typologies - tundra, steppe, forest and wetland, integrating augmented micro-climates that will enable the park to function as a public space throughout Russia's extreme winters.

4. Invisible Architecture

Invisible architecture is the calling card of science fiction design.

The idea is to "blur the perceptual boundary" between object and setting. push the boundaries of what invisible really means.

5. Natural Disaster-Proof Forts

From adverse weather conditions on the coast , the artist DionisioGonzález designed dreamlike, futuristic forts made from iron and concrete, fusing the role of artist with that of architect, engineer and urban planner. The peculiar edifices -- the hybrid of a beach house, a bunker and a space ship.

6. Green Power Plants

What is there to do with an outdated, eyesore of a power plant in the future?

A new industrial complex, one that would be built up from the previous facilities and wrapped with a corrugated skin of creeper plants. This strategically-placed skin would not only soften the exterior aesthetic of the plant, but it would create a sheath of creepers to absorb CO2 emissions.

7. 3D-Printed Interiors

Forget interior decorators, the future of indoor design will be run by 3D printers. Architects Michael Hansmeyer and Benjamin Dillenburger the duo 3D printed an entire room, creating a 16-square-meter cube adorned with unbelievable ornamentation that looks like it belongs in a futuristic cathedral.

8. Sci-Fi Skylines

Skyscrapers, office blocks and public spaces meant to mimic the appearance of mountains, hills and lakes depicted in Chinese landscape paintings. The complex is now under construction in Beijing, and will result in an expansive sky line seemingly ripped from the pages of a futuristic novel.

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УДК 7

Функциональная и уютная маленькая квартира

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Functional and cozy small apartment

This article was written to help you create a comfortable, cozy, beautiful, relaxing, but at the same time and functional space in your home. Probably each of us thought at least once about how to change something in our home. Here are collected tips designers, architects, florists and just experienced people in order to create their own space.

I believe the design theme of small apartment is relevant now because there is numerous construction houses with small apartments in provincial towns and the young families can't afford expensive repairs.

Functional planning of a small residential apartment

Every apartment should have equipped for it residents and for it hobby in order for comfortable human live.

Steps of planning your home interior is preliminary research

Step №1: This first step is explained in detail in Preliminary research, which covers: examining your current home and lifestyle, developing your design brief, deciding your baseline budget, exploring sources of professional advice for each stage of decision, familiarising yourself with the advice in this guide to inform your brief.

Step №2: Site analysis. Visit the site (view for flat) to do a 'first sketch' analysis (strengths, weaknesses, opportunities and threats).

Step №3: Truthful plan of you flat. You should do plan of you apartment, respecting all sizes (wall height, the length of the wall, distance to outlets and lamps, the dimensions of the window, the width and length of bearing walls and so on).

Step №4: Zoning. You should decide, where you want to do bedroom, office, laundry, living room and so on.

Step №5: Equipment. You should take a size of all subjects of furniture (dimensions) and do some sketches of different furniture placement. This placement must be comfortable for you and your roommates. Use furniture placement to organize furnishings into smaller groups within the studio. Since you don't have walls to create boundaries, use furniture, rugs and lighting to create separate areas while still keeping the space open and airy.

Step №6: When you decide, how the furniture placement, you can do design of your flat, correcting furniture at need.

Store things

Living in a compact flat sometimes resembles a giant game of Tetris. Here are a few of the ways that you can manage.

Tip №1. Utilize vertical and hidden storage. In a small space vertical and hidden storage is your best friend. For storing collectibles, books, and displaying decor, utilize tall display storage, shelving over doorways, and open shelving throughout your apartment. Hidden storage under beds, hanging organization accessories on the back of doors, and installing vertical storage in cabinets, can drastically maximize your storage capacity. In clothing closets, hang shelving in double tiers, and at varying heights to get the most of your closet storage.

Tip №2. Take advantage of any dead space. You should purchase sliding drawers to take advantage of the space under the bed, have storage boxes under the sofa and have baskets to utilize the space over cabinets.

Tip №3. Find storage offsite. This might sound crazy but compromise between the Public Storage unit (which is a ways away) and in the apartment is the trunk of the car. Items like suitcases that are frequently used, relatively inexpensive and bulky often tend to reside there full time.

Tip №4. Prioritize. You should rotate your wardrobe so that off season items don't take up precious storage space, and while you have a wish list of kitchen appliances you only purchase the ones you know that you will use almost daily. You should also pare down the dishes in the cupboard to five of each item and put the rest of the set into storage.

Tip №5. Make it multifunctional. Whether you live in a one bedroom, studio, or if you just have a lot of roommates, your apartment should be able to utilize one space for several functions. Your dining room table could serve as an office for your laptop when not eating, dining table at meal time, and possibly a work surface when doing hobbies and crafts. Utilize kitchen bar area for sitting, entertaining, dining, and extra work surface space when cooking. In your living room, use futons, and sleeper sofa beds for a couch in the day, and a sleeping area at night. We also love multipurpose furnishings, and in a small space like a studio, they can be a real lifesaver. Any piece of furniture that does double duty is a good friend to have around.

Nine advice on design

Advice №1. Use light and color to your advantage: To make your apartment look larger, let ample light into your home as much as possible. Also use light colors, neutrals, and muted tones to maximize visual space. When your home looks larger, you will feel better and more at home in your small space. Try to avoid compartmentalizing your rooms with color. Use a unifying color throughout your home, like a neutral and define spaces with accent walls or with varying hues of the same color. This will make your apartment visually read as one large space.

Advice №2.Bring in eye catching furnishings: Even though your space is small doesn’t mean you can’t maximize on style! The great thing about having a small apartment is you don’t need a lot of furniture. For the few pieces that you do have, make them special and eye catching. A beautiful headboard in your bedroom, or even an entertainment center that commands attention from all your guests, can make your apartment interiors fun and enjoyable to be in. Don’t forget your walls too. Artwork, murals, and wall decals can make your walls come alive with color and life without much work. The more visually appealing your decor and furnishings, the easier it will be to remember how larger your space actually is.

Advice №3. Let in the Light: Avoid heavy curtains and add lots of light fixtures to make your studio feel larger, cleaner and more welcoming.

Advice №4. Add Artwork: Having your own art on the walls can make a huge difference in adding personality to your space. There are a lot of ways to hang art without ever picking up a hammer, so even renters can enjoy a sexy gallery wall.

Advice №5. Control Clutter: We know you love those piles of throw pillows, but in a small space, decoration displays can start feeling chaotic. To avoid the clutter, choose one distinctive piece to display or make a grouping of all one color or shape.

Advice №6. Don’t Block the Light: Even though you want to create spaces and have privacy for the bedroom, make sure you don’t block your light sources. Use wall partitions or open shelving to avoid making your studio feel dark and cramped.

Advice №7. Use Mirrors to Add Depth: Mirrors are great for “doubling” your space. If you place them opposite a window, they act as a second window, reflecting double the light back into your studio.

Advice №8. Coordinate your Rugs: One of the advantages to a small studio is not having to spend a fortune on a full-sized area rug. Having a small colorful rug anchors the illusion of “rooms” and provides extra color and texture to balance out your wall decor.

Advice №9. Add Plants: Not only are plants proven to increase productivity, they filter the air and create a homey atmosphere.

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AK ASSAULT RIFLE MODERNIZATION

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Currently, we can see global modernization in all fields of life and weapon modernization is not an exception. There are a lot of companies which provide modernized weapon produced with high-tech technology and equipment.

The aim of this paper is to highlight the basic trends in Russian military equipment and weapon development on the example of a world-famous firm Kalashnikov Concern .

The most well known company in Russia is a Kalashnikov Concern. Kalashnikov Concern is Russia's largest manufacturer of automatic and sniper weapons, guided artillery shells, and a wide range of civilian products, including hunting rifles, sporting rifles, machines, and tools. Kalashnikov Concern products can be found in 27 countries, including the USA, the UK, Germany, Norway, Italy, Canada, Kazakhstan, and Thailand. Alexey Krivoruchko manages the company[3]. Izhmash is a multipurpose company focused on production of:

- combat small arms
- sports and hunting arms
- aircraft cannons
- improved conventional munition projectiles
- checkout equipment for operated weapon systems
- new motorcycle models
- compact cars
- industrial machines
- high-quality tools and point billets

Almost everyone in the world has seen the firearm that bears his name, the AK-47 Assault Rifle. AK stands for "the assault rifle by Kalashnikov," the former Red Army sergeant who created its prototype at the beginning of the Cold War. In 1947 the Soviet army accepted the prototype for mass production.

What makes the Kalashnikov assault rifle popular ? Firstly, its simple design, ease of operation and excellent reliability. Secondly, this gun can be used in any weather and at any temperatures from the freezing Arctic to equatorial heat. Thirdly, the assault rifle is highly resistant to fouling – even if small grains of sand, water, or mud get inside the rifle, it can still be fired. Mikhail Timofeevich Kalashnikov was conscripted to serve in the Red Army in the fall of 1938. It was then that he demonstrated his inventor skills by developing an inertial shot counter for a tank cannon, an attachment to the Tokarev handgun to make it more effective for shooting through firing slits in the tank's turrets, and a engine life counter for tanks. By 1946, Mikhail T. Kalashnikov created several firearm designs, including two machinegun pistols, one of which had a very original semi-free bolt braking system, a hand-held machine gun and a self-loading carbine fed from cartridge cartons.

In December of the same year, the first early version of an experimental automatic rifle was produced at an arms factory in Kovrov, chambered for the intermediate 7.62×39 mm cartridge, which is now sometimes designated as AK-46, was presented for testing. This early version did not have many features of the future AK: it had its pullback cocking lever on the left, and there were two separate flag-type safety and firing selector instead of the now-customary single safety/fire selector, while the firing mechanism cover flapped open down and forward on a pin. After the tests, the original Kalashnikov assault rifle was deemed to be

inadequate for further development. However, Mikhail T. Kalashnikov appealed that decision, returning to Kovrov for this purpose, where he developed what was essentially a completely new assault rifle, within a record time. Only after the second round of tests in 1947, the prototype was recognized as the most reliable. After initial army trials in 1949, the Kalashnikov assault rifle was formally approved for service as the 1947-type 7.62mm Kalashnikov submachine gun. In the same year, Mikhail T. Kalashnikov was hired to join the senior designer's team at Izhmash, where he got involved in developing and upgrading the AK-47 further [1]. The development of the rifle can be presented as following:

Kalashnikov AKM

Upgraded AKM and AKMS assault rifles were put into service in the late 1950s. Changes in production technology and use of plastics could reduce the weight of the weapon by 700 grams compared to the original. Higher accuracy and lower closer pattern of bullet spread were achieved by adding a trigger retardant, which reduced the rate of fire from 660 to 600 rpm; the bolt carrier assembly was modified as well. A muzzle brake was later added to the AKM to reduce the barrel climb when firing. The accurate firing range was increased to 1000 meters.

Kalashnikov AK-74

Development of small arms over the past 200 years has gone hand-in-hand with consistent reduction in weapon caliber. As soon as practical experience confirmed that smaller calibers are both possible and useful (this point had been supported by theory years before that), full-scale development work on smaller-caliber weapons started both in the Soviet Union and other countries. An assault rifle chambered for a 5.45mm cartridge was adopted for service in 1974 as the Kalashnikov AK-74. The related man-portable machine gun RPK-74 and AKS-74 assault rifle with a folding stock for paratroopers were introduced at the same time. The smaller caliber helped to reduce the magazine weight, while increasing the bullet's barrel velocity to 900 m/s, while a new design of the muzzle brake made it possible not only to offset the recoil, but also make shooting less loud.The left-hand grip and stock of the new assault rifles were originally made of wood, but later, they began to be manufactured from plastic. The so-called "night" version, Kalashnikov AK-74N were introduced with a side rib for attaching infrared night-vision scopes.

Kalashnikov AK-74M

The fourth generation of Kalashnikov assault rifles began with the Kalashnikov AK-74M, which was adopted for service by the Russian army from the early 1990s. The main differentiator of this assault rifle from previous models was that it replaced all of AK-74, AKS-74 and AK-74N thanks to having a black plastic folding stock (folding to the left) and a universal rib for attaching scopes on the left of the receiver. In addition, the receiver cover was reinforced to prevent it from detaching catastrophically when firing a 40mm under-barrel grenade launcher. In the next round of upgrades, Izhmash began to develop 100-series of AK rifles chambered for the most common cartridges: the 7.62x39 mm (AK-103 and AK-104), the 5.56x45 mm (AK-101 and AK-102) and the 5.45x39 mm, which expanded the market for the assault rifle many times over.

Kalashnikov AK-12

The new assault carbine was developed from June 2011, with firearms designer Vladimir V. Zlobin leading the development effort and using the ideas and new concepts developed over the previous decade. The key difference of the new carbine is its improved ergonomics: a person can operate the mechanical controls of the assault rifle with one hand: a soldier can still do everything he needs to do with the weapon: move the safety, pull back the bolt and replace the magazine even if wounded or when using his other hand. The new weapon also features modern sights, better-quality barrel, smoother automatic action, an ability to fire submachine gun cartridges of different types and attach advanced under-barrel

grenade launchers. The AK-12 uses long-action operating rod with a rotating bolt. However, the bolt assembly and the dual action trigger firing mechanism have seen substantial improvements. The assault carbine has a folding adjustable-length and cheek piece height plastic stock. In addition, the bore centerline is aligned with the stock in the AK-12, reducing the recoil shoulder, which helps to improve firing accuracy. One of the most highly anticipated innovations in AK-12 design was the last-round catch with a button on the right-hand side of the receiver, above the magazine. Adding this part helped to reduce significantly the reloading/magazine-changing time. The AK-12 assault carbine also has a new ergonomic fire selector control [2].

After comparing the oldest and new guns we can conclude that in Russia the weapon modernization has taken long time and depended on the customer's needs, method of upgrading and the quality of the equipment, but the main construction has never been changed. The main customer of this weapon is the Russian army because after the extensive and long-term application, this weapon has became fence to our solders.

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УДК 621.313.13

ELECTROHYDRAULIC EFFECT IN NEXT-GENERATION ENGINES

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Electrohydraulic effect (EHE, Yutkin effect) was discovered by L.Yutkin and L.Goltsova in 1950. Since then, it has received more than 150 copyright certificates to methods and devices used in various sectors of economy and industry. L.Yutkinand L.Goltsova found that the basis of EHE is the conversion of electrical energy into mechanical energy. This process is accompanied by a sharp increase in pressure, the occurrence of electromagnetic fields and various types of radiation: ultrasound, light, heat, ultraviolet and X-rays. All this produces a drastic change in the material composition of processed solid materials and liquids, in which EHE is executed, affecting it's both chemical and physical properties.

EHE occurs in liquids or solids. When applying a high voltage pulse in the working fluid between two electrodes a discharge takes place. Around the discharge a small amount of the working fluid boils immediately (sublimes) and thus it expands. Expansion occurs at high speed (in liquid – above the speed of sound), a shock wave appears.

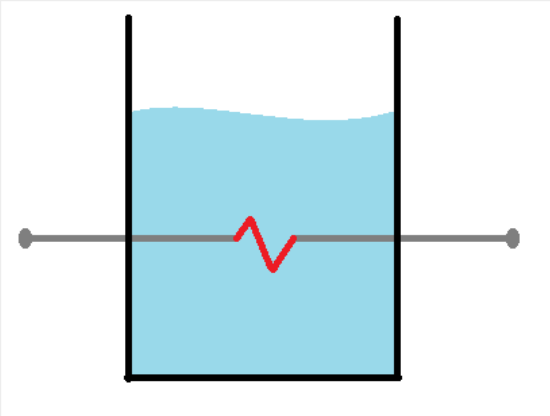

Figure 1 – Scheme of electrohydraulic effect

The conducted experiment shows that the Yutkin effect is achievable even at low power (about 60 watts). The experimental setup consists of a source of high-voltage electric impulses and a small container with a piston and a pair of electrodes. When the discharge happens the piston shoots out.

To date, the Yutkin effect is consideredto be one of the most effective ways to convert electrical energy into mechanical energy. Due to the high efficiency this effect has enormous potential in propulsion engineering.

Engine running on EHE will have a number of distinctive features in comparison with a conventional internal combustion engine.

There is no mechanical energy loss. In conventional engines detonation occurs when crank mechanism is in so-called top dead center. At this point force cannot do any work, efficiency is zero. On the other hand, in EHE-engine the moment of discharge is chosen freely. The preferable moment is when the angle between crank and connecting rod is 90 degrees.

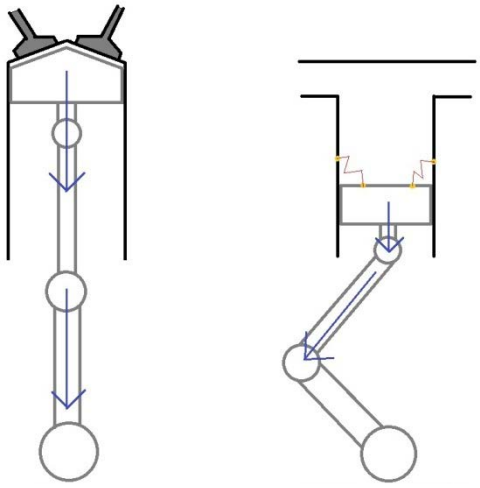

Figure 2 – Comparison of internal combustion engine cylinder and EHE-engine cylinder

1) The fluid is incompressible (or a little compressible), therefore, it should be flowing, because cylinder volume changes.

2) The time of the explosion is very small, so the great force is exerted on the cylinder and piston for a short time, and the materials must be very strong.

3) The piston is pushed not with high pressure but with shock wave, therefore, it's possible to use more than one piston in a cylinder.

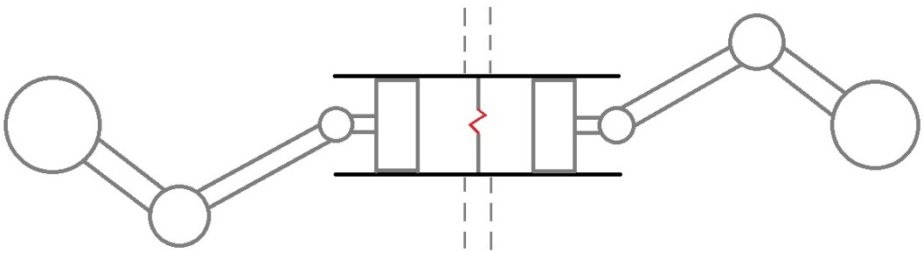

Figure 3 – Doublepistoncylinder

4) EHE motor needs no cooling system, complex fuel system, air supply system, etc. This makes the construction more simple, reliable, compact and light.

5) There are no emissions into the environment, therefore, this engine is completely environmentally friendly.

Today electrohydraulic effect has a huge spread, it is used in a wide range of industries, thanks to its amazing features and efficiency. Despite this, no one has built the engine working on EHE. This is the problem which is necessary to be solved.

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УДК 539.1

NANOPARTICLES AND MICROCAPSULES: APPLICATIONS FOR DRUG DELIVERY AND IMAGING

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I think, it's high time to speak about new modern pharmacological tools in terms of technological innovations.

Firstly, I'd like to tell about a preparation conjugated polyelectrolyte nanoparticles with improvement their properties. The synthesis and single-chain nanoparticle fabrication for polyfluorene-benzoxadiazoledibromide (PFBD) was studied. PFBD-based nanoparticles were fabricated by following two methods. The first method uses simple stirring and the second one applies ultrasonication (Figure 1A). The sizes and morphologies were studied and compared with two obtained types of PFBD-based nanoparticles. The results are summarized in Table 1.

Table 1. Size (l, nm), average fluorescence lifetime (t, ns), radiative rate constant (k_R, s^{-1}) and nonradiative rate constant (k_{NR}, 1^{-1})

Samples	l [nm]	t [ns]	k_R [s^{-1}]	k_{NR} [1^{-1}]
PFBD-I	20-70	0.52	9.62×10^7	1.87×10^9
PFBD-II	4±1	1.16	2.24×10^8	6.38×10^8

The sizes and morphologies of PFBD-I and PFBD-II were studied by transmission of electron microscope. PFBD-I nanoparticles have irregular shape and different sizes from 20 to 70 nm; PFBD-II nanoparticles exhibit relatively homogenous shapes and sizes with a mean diameter 4±1 nm (Figure 1B and Figure 1C respectively).

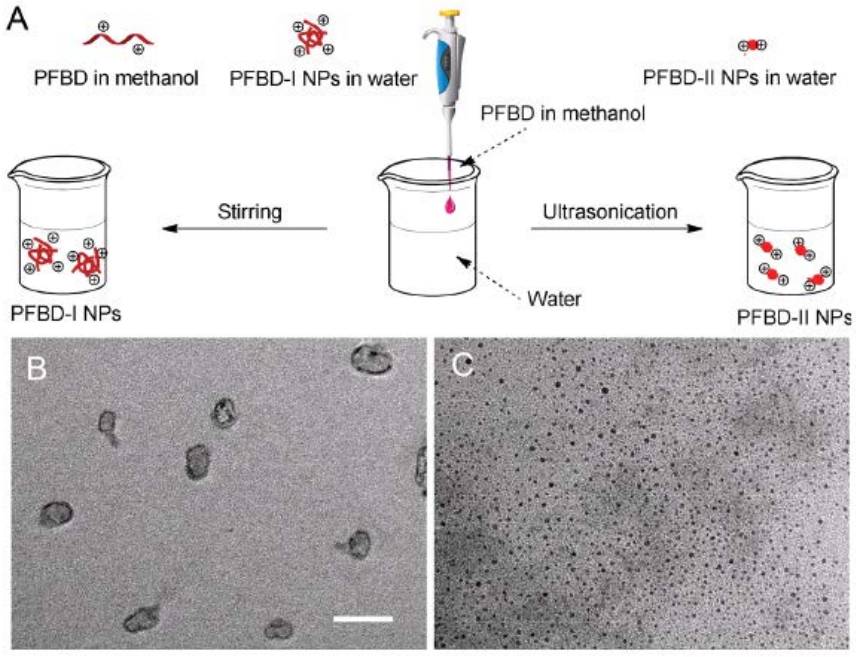

Figure 1. (A) Schematic illustration of the fabrication of PFBD-I and PFBD-II nanoparticles in water. (B) and (C) are the TEM images of PFBD-I nanoparticles and PFBD-II nanoparticles with the same scale bar of 100 nm, respectively

The average fluorescence lifetime of PFBD-II nanoparticles was measured and composed 1.16 ns which is more than 50% longer than that of PFBD-I nanoparticles (0.52 ns). The fluorescence radiative rate constant (k_R) and nonradiative rate constant (k_{NR}) were estimated by the quantum yield (5% to PFBD-I and 26% to PFBD-II in water) [$QY = k_R/(k_R + k_{NR})$] and lifetime results [$t = (k_R + k_{NR})^{-1}$]. As it is shown in Table 1, PFBD-II nanoparticles in water show a k_{NR} of $\approx 6.38 \times 10^8$ s^{-1} which is much slower than that of PFBD-I nanoparticles ($\approx 1.87 \times 10^9$ s^{-1}). The nonradiative decay pathways of PFBD-II nanoparticles in water have been efficiently blocked with respect to that of PFBD-II nanoparticles. The increased lifetime of PFBD-II nanoparticles is considered to be the emission from PFBD in a singlet state with considerable charge-transfer character. Interaction between the conjugated backbone and the polar aqueous environment is significantly reduced and the nonradiative decay rate is decreased with the enhanced quantum yield and prolonged fluorescence lifetime.

The fluorescence properties of PFBD-II nanoparticles were compared with commercially available QD655. As a result PFBD-II nanoparticles have a strong affinity to the surface of the glass cover side due to the electrostatic interactions. The average number of photons emitted per second by PFBDnanoparticles ($\approx 1.90 \times 10^6$)in comparison with that by QD655 ($\approx 1.42 \times 10^6$) indicates that as usual a single PFBD-II nanoparticle is brighter than a single QD655. As the most widely used fluorescent imaging materials, these results reveal that PFBD-II nanoparticles are promising for bioimaging applications.

The hydrophobic conjugated backbones of PFBD-II nanoparticles are likely to be embedded inside the nanoparticles while the positively charged side is extended outside in aqueous environment.

But most drugs can be harmful to the body if they are not delivered to the targeted site of action at an optimal concentration, because conventional formulations indiscriminately distribute drugs to the entire body and a therapeutic dose cannot be manipulated.

Polysaccharide-based nanoparticles are of interest as carriers for imaging and therapeutic agent. Unique physicochemical properties, including biocompatibility and biodegradability are very important in this field of scientific research. The size and surface characteristics of nanoparticles may play a key role in the process when smaller particles tend to circulate larger particles for a longer time.

Many anticancer drug-loaded self-assembled chitosan nanoparticles have been modified with polyethylene glycol to reduce the surface charge. Even though polysaccharide amphiphilescan form self-assembled nanoparticles at low critical aggregation concentrations, their stability needs to be improved. One of the effective methods for that is chemical crosslinking of polysaccharide nanoparticles.

For improving their targetability several moietieshave been conjugated to other polysaccharide-based nanoparticles (for example, chitosan nanoparticles have been conjugated with folic acid molecules and peptide moieties) to improve their targetability.

Created polyelectrolyte multilayer capsules can provide indispensable means for the delivery of nanoparticles into target cells. One research line is based on using a laser source operating in the biologically safe near-infrared region of the spectrum to activate or open polyelectrolyte multilayer capsules remotely. The light-absorbing matter was insertedinto the walls of polyelectrolyte multilayer capsules.

Microcapsules carrying magnetic nanoparticles can be trapped locally in a magnetic field gradient and delivered to specific locations inside a cell.

The pH-indused spectral shift of a pH indicator can help with monitoring the ways of a capsule. Ratiometricfluorescence intensity calculations could successfully be deduced from single-capsule confocal laser and are used for local pH monitoring.

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TECHNOLOGICAL DECISIONS ABOUT AUTOMATIZATION PROCESS OF THE RECYCLING THE ELEKTROLYTECONTAINING MATERIALS WITH THEIR RETURNING BACK TO PRODUCTION

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The paper considers thepossibility of processingand returning to the production of one type of solid alumina-containig waste of the aluminum production, which are named sweepings.

Valueof the sweepings is determined by the amount ofthe main components of the electrolyte (Na_3AlF_6, $Na_5Al_3F_{14}$, Al_2O_3, AlF_3). At the same time, composition of the sweepings includes ferriferous and siliferous phases SiO_2, Fe_2O_3, $Na[AlSi_3O_8]$, Fe_2SiO_4, which should notget into theelectrolyte. It is worth noting, that previously thiswaste are notprocessedandsentto the dump.

We investigated two sweepings parties, which aresignificantlydiffer inparticle sizeand chemical composition.It was determined thatthe initial compositionhas a significant influenceon the decisionabout the possibility ofrecycling, so it needs a quality inspectionof incomingmaterialto the establishedlimitson the initialcontent ofthe oxidesof aluminum, iron, silicon, carbonand elementalfluorine.Moreover, recycling of total weight of the material, does not allowobtaining a productwith an acceptablecontent ofsilicon and iron oxides. So, for the recyclingrecommended the selection of the fractions, which are containing the minimum amount of contaminants(carbon, silicon and iron oxides).

Concentrationof the sweepings iscarriedby flotation. Tests were conducted on flotation machine FML0.3 to 0.3 liter section with the crushed material lots1 and 2.

The controllableparameters in theresult of theflotation are the outputof the section product,and recoveringC, Al_2O_3, SiO_2, $Fe_2O_3$and F in the sectionproduct.To control the elemental and phase of the composition used X-ray diffraction and chemical analysis.

Flotigam7266 was selected as a flotation reagent, characterized by selectivitytorecoverablecomponents(SiO_2, Fe_2O_3).When flotation kerosene and pine oil were injected to transform carbon into thetails.The range of the concentration of Flotigam 7266 is chosen for testing both parties of material is based on customer’s recommendations.

The carried-out tests allowed to define the optimum duration of flotation - 10 min. With increase in time of flotation the exit of an industrial product decreases significantly and the extraction of all studied phases in a in a flotation tail decreases too.

Influence of density of a fine pulp on quality of the received industrial product was defined at two relations S:L (strong : liquid) (1:10 and 1:15). The carried-out tests in the chosen area S:L didn't show any significant changes of the contents and extraction of oxides of aluminum, silicon, iron, and also fluorine and carbon. The conclusion of this part is that further dilution of a pulp isn't rational, It is connected with the increasing of the water consumption on flotation which practically doesn't change the quality of a product.

The choice of fractional composition of material was carried out on the basis of the RSA of various fractions of material. For recycling as flotation method were chosen two fractions: The fraction +5 (with the greatest number of the electrolyte-containing materials and with the smallest content of oxides of silicon and iron) and the fraction of-0,071 mm, which contain alumina (generally) and the minimum quantity of oxides of iron and silicon.

As a result of processing of electrolyte-containing fraction (-0,071 mm) of the second part material was received the flotation tail with rather high content of alumina (about 90%)

and element fluorine (about 5 %). The content of the oxides of silicon and iron managed to be lowered to 0,35 and 0,18 %. With processing of the large electrolyte-containing fraction (+5,0 mm) was received the product with the high content of alumina and fluorinated components in the presence of the small content of carbon and minimum content of oxide of iron 0,13 %. However the product contains a significant amount of oxide of silicon (about 1,0 %). Further use of this product possibly for receiving the aluminia-contained alloys.

On the basis of the analysis of the received results of cleaning the sweepings with a flotation method, and also their chemical and granulometric analysis is offered the technological scheme.

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УДК 620.9

PROSPECTS OF NUCLEAR POWER ENGINEERING

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Nuclear power engineering is one of the most newest spheres of the power engineering. During its existence and developing everybody has understood that it's the most forward-looking sphere in engineering. Technologies based on the nuclear decay or fusion can literally change the world in the near future.

It took about 40 years to develop nuclear power engineering to the level we're having today. The resultsare: 400 power generating units in more than 26 countries with the summary electricity capacity about 300 million kilowatt.The most considerable advantages of nuclear power engineering are the high level of final efficiency and the absence of harmful emissions to the atmosphere, including the absence of combustion products. As for disadvantages of nuclear power engineering, there are some important aspects: potential danger of radioactive contamination of the environment by products of disintegration of nuclear fuel in case of accident as well as the problem of processing of used nuclear fuel.

At first, let's dwell on pluses. The efficiency of nuclear power engineering is formed by some components. One of them is the independence from the transportation of fuel. For the electric power station with the capacity of 1 million kilowatt is needed about 5 million tons per year, while for the block VVAR-1000 is needed not more than 30 thousands of enriched uranium, that reduces to zero expenses on the transportation of fuel (while coal-fired plant's expenses on the transportation are 50% cost price). The using of the nuclear fuel for producing of energy doesn't need oxygen that means the absence of combustion products. As consequence, installations for refinement of emissions are not needed as well. Cities, located close to nuclear plants, are mainly ecofriendly, green cities in all countries. If it isn't so, the reason is the influence of other factories and objects, located on the same territory.

One of the most important disadvantages of nuclear power engineering is the potential danger of radioactive contamination of the environment by severe accidents like the Chernobyl nuclear disaster. Today the nuclear plants, using the reactors like there were in Chernobyl, take measures for additional security, which according to the conclusion of IAEA (International Atomic Energy Agency) completely excludes the possibility of the familiar severity. Nevertheless, the social opinion about nuclear power engineering probably will not change in the near future. The problem of utilization of radioactive waste worries the whole world community. Nowadays there are some harmless methods of dumping the radioactive wastes. The one more problem rises here: there is a need in territory for dumping, where all the radioactive wastes would be hosted forever. Countries with small territory and high population density suffer from serious difficulties by solving this problem.

While considering the issues about prospects of nuclear power engineering in the near future andat a later time we should take into account the influence of many factors: limitation of resources of natural uranium, the high cost of the capital building and organization of atomic plant in comparison with a thermal power station, the negative social opinion. At the same time the availability of large reserve of already mined and enriched uranium, as well as the released uranium by the dismounting of nuclear warheads solve the problem of limitation of natural uranium that could increase the capability of the atomic energy up to 200-300 Q. This reserve exceeds the resources of organic fuel and allows to build the base of universal energy over 200-300 years.

Nevertheless, technologies of extended reproduction didn't pass the stage of mass production because of retardation in the sphere of processing and recycling (extraction of "effective" uranium from waste fuel). The most widespread modern reactors use only 0.506% of uranium (mainly isotope U238, which concentration in natural uranium is 0.7%). Because of such a low efficiency of using the uranium, energetic capability of nuclear power engineering is estimated only at 35Q. However, it could seem acceptable for the world community for the near future and subject to the relation between atomic and traditional power engineering. Moreover, the technology of extended reproduction gives considerable additional ecological load. Nowadays, experts understand, that nuclear energy actually is the only real and considerable source of supplying with electric power thewhole mankind in long-term view, the source, which doesn't cause the greenhouse effect, acid rain, etc. As it is known, today's power engineering, based on organic fuel (i.e. burning coal, petroleum, natural gas), is the foundation of producing the electric power in the world. Tendency to saving the organic kinds of fuel, which is the valuable raw material, the regulation of critical amount of carbon monoxide and pursuit of lowering of it's level – all this testify to the necessity of progress in the sphere of nuclear power engineering.

Taking into account all what was mentioned, we can make a conclusion that perspectives of developing of nuclear power engineering will be various for different regions and single countries reasoning from needs in electric power, scope of the territory, having the reserves of organic fuel, financial possibilities for building quite an expensive technology, for building the influence on the social opinion in this country.

Separately we observe the perspectives of nuclear power engineering in Russia. Created in Russia secluded research-and-production complex of enterprises includes all spheres, needed for functioning of atomic power engineering and processing of ore, metallurgy, chemistry, radiochemistry, mechanical engineering. Industrial and resource potential allows to provide the stable work and progress in the atomic power sphere in Russia and CIS over the many years. Russia can export natural and enriched uranium on the world market, taking into account the highest level on some directions that gives the opportunity to keep position on world uranium market in conditions of absolute competition.

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УДК 62-2142

SOME INNOVATIVE IDEAS IN AUTOINDUSTRY

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Today's automobile is one of the most sophisticated mechanisms owned by consumers. Virtually every aspect of the modern automobile is now high-tech, uses a high-tech material or was developed through a high-tech process. Modern manufacturers all over the world try to take into consideration all the needs of contemporary society. They realize that an automobile must function in the harshest climate conditions, from freezing cold to 100% humidity to desert temperatures running on the roughest roads, from urban potholes to unpaved country roads, performing at highway speeds for as much as a 150,000-mile lifetime while meeting thousands of regulatory standards.

Most of the car producers consider that it is an exciting time to be a part of the automobile industry, even though the demands on the business have never been greater. Customer expectations of vehicle quality, reliability, safety, and utility are really high. At the same time, worldwide overcapacity has put pressure on the industry to maintain, and even reduce, vehicle price.

The automotive industry is carrying out an extensive work to revolutionize the transport system. This will make roads safer and allow an improved traffic flow therefore cutting emissions. Key areas being developed include Intelligent Transport Systems (ITS) which allow vehicle-to-vehicle and vehicle-to-infrastructure communication. Implementing these communication systems can help to reduce road accidents, relieve congestion and reduce emissions. Examples of ITS applications in use today include urban and motorway traffic management and control systems, electronic toll collection and route navigation systems. There are also a number of technologies connected with the automotive lighting systems: Intelligent Light System (ILS), Lighting Control System (LCS). We would like to describe them one by one.

Intelligent Light System

A new generation of adaptive car headlamps technology which is now entering series production was offered by Mercedes-Benz. This system is adapted to the prevailing driving and weather conditions, thereby significantly enhancing safety.

New lighting system increases the driver's range of visibility by up to 50 meters. The Intelligent Light System also includes the active light and cornering light functions, enhancing fog lamps which illuminate the road edges and therefore provide even better orientation when visibility is poor. The new, intelligent headlamps are a continuation of many years of effort by Mercedes-Benz to make driving safer at night.

Mercedes-Benz plans to combine the Intelligent Light System with the bi-xenon headlamps offered as an option in the E-Class, becoming the first manufacturer to provide its customers with the best lighting technology currently available. In the E-Class Mercedes-Benz has upgraded its bi-xenon low-beam headlamps with their highly effective, asymmetrical light distribution into a new country mode which illuminates the left-hand edge of the road more widely and brightly.

The driver's range of vision is increased by around ten meters, which gives him better orientation in the dark and allows him to respond more rapidly when other road users cross his path.

Far-reaching: new motorway mode with longer range

From a road speed of 90 km/h the new motorway mode is automatically switched on in two stages: in stage one the output of the xenon lamps is increased from 35 to 38 watts, and in stage two the range of the nearside headlamp is increased when a speed of 110 km/h is reached.

The result is a uniform cone of light which illuminates the entire road width to a range of up to 120 meters. At the center of this cone the driver is able to see around 50 meters further than with conventional low beams, which allow him to recognize vehicles, even at very long distances, and adapt his driving style accordingly. The enhanced fog lamps, which are also part of the new Intelligent Light System, provide better orientation in adverse weather conditions.

If visibility becomes less than 50 meters, the vehicle speed falls below 70 km/h and the driver switches on the rear fog lamp, the left bi-xenon headlamp of the E-Class swivels outwards by eight degrees and, at the same time, lowers the cone of light.

This illuminates the nearside of the road more efficiently, while the wider beam reduces back glare in fog. The enhanced fog lamps remain switched on up to a speed of 100 km/h. The active light function, which Mercedes-Benz first offered in the E-Class in spring 2003, has been developed further by the engineers in Sindelfingen.

With the active light function, which operates at both low beam and main beam, the bi-xenon headlamps automatically follow the steering angle. Road illumination is improved by up to 90 percent when negotiating bends. The Intelligent Light System also includes the cornering light function, in which one of the two fog lamps is automatically switched on when the driver operates an indicator or turns the steering wheel.As a result, the range of side visibility ahead of the vehicle is increased by around 30 meters. The cornering light function is activated up to a speed of 40 km/h.

Active Light System Interior: ambient lighting as a safety factor

In addition to the new Intelligent Light System, the Mercedes-Benz E-Class also offers a unique lighting concept in the interior: ambient lighting, which provides effective yet discreet and glare-free illumination of the interior for driving at night. The headlamps follow the steering movements.

The system incorporates light-emitting diodes (LEDs) in the door handle recesses and footwalls, as well as special luminous panels in the roof liner. This means that the sense of spaciousness and the high quality of the interior can also be appreciated by night. The E-Class is the only car in its market segment to feature such a sophisticated and well-conceived lighting concept for the interior.

It not only ensures a particularly pleasant interior lighting mood, but also enhances the drivers operating and perceptive safety during the hours of darkness. This is because the permanent interior lighting lends better visual support to control processes and allows easier recognition of the switch arrays in the center console. It also reduces the need for the eyes to adapt to the difference in brightness between the vehicle interior and the road, which means less strain on the eyes and therefore less rapid fatigue. Furthermore, a pleasant “visual atmosphere” makes a major contribution to driver-fitness safety because the ambient lighting has a psychologically and biologically stimulating effect on the driver and therefore improves his performance potential.

Lighting Control System

Intelligent outdoor lighting control system (ILS) is an important part of the whole concept of security, as it gives the driver a better view. It helps to notice the danger earlier. In the "highway light" dipped beam is distributed in such a way that the left edge of the

carriageway is illuminated significantly better than with conventional headlights. Thesystem" is adjusted depending on the speed of motion to evenly illuminate the lane on its entire width and at a distance of about 120 meters. By using "extended" fog light ILS system improves visibility in foggy conditions. To do this, left Bi-Xenon headlights turn out, while lowering the light cone down. This function is activated automatically as soon as the driver turn on the rear fog light, moving at a speed not exceeding 70 km / h. Additional features Adaptive Forward Lighting control systems, lights in the registration of other road users will switch to dipped beam, and coverage range will vary depending on the distance to oncoming and passing cars. Thus, the Adaptive Forward Lighting control provides the driver an optimal range of coverage - up to 300 meters in the case of low beam. So it will be better able to recognize and before course of the road, pedestrians and dangerous areas on it. On clear roads, the range of coverage will increase again to ensure maximum range coverage. So now there is no need to manually switch between dipped and main beam. Ray "dynamic rotating light" will follow the rotation of the steering wheel: Bi-Xenon headlights in a fraction of a second turn in the direction in which the driver will send your car. The "side" light is dim fog, when the driver activates the direction indicator or turns the steering wheel, intending to roll.

«Audi Matrix LED»

Audi is one of the first applying LED Head Light in their models. Now LED headlamps are usedby many manufacturers as optional equipment. But Audi went further by developing a matrix LED headlights. The development is called «Audi Matrix LED».The new Matrix LED technology is activated from a speed of 30 km/h outside built-up areas and from 60 km/h in towns and cities. This happens only if the light switch in the new Audi A8 is set to “automatic” and the high-beam headlights are on.

But the Matrix LED headlights can do even more: with new functions, they provide greater safety. These include the marker lights that work together with the optional night vision assistant. As soon as a pedestrian is detected in a critical range in front of the vehicle, individual LEDs flash briefly three timeфs in succession to alert that person, who is then clearly visible to the driver.In addition, the Audi Matrix LED headlights also function as a cornering light. Using predictive route data supplied by the MMI navigation plus, the focus of the beam is shifted towards the bend even before the driver turns the steering wheel.

Audi is moving to incorporate OLED (organic LED) lighting into its clever Matrix headlight technology, the one where a multitude of individual lights are switched on and off to effectively “shadow” oncoming cars and pedestrians from the headlights’ dazzle. The point of all this is to allow the headlights to run high beams effectively all the time without blinding other road users—even during the day.

The automotive lighting technology is already integrated into the rear lights of the Audi R8. The illuminated LEDs on the new Audi A8 now flash in blocks inside the headlight too, in the direction in which the driver intends to turn. The turn signal is therefore more intuitive and is recognised more quickly.

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УДК 712.4

MOBILE LANDSCAPING AS A MEANS OF IMPROVING THE QUALITY OF MODERN URBAN ENVIRONMENT

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As everyone knows, one of the most important contemporary issues is the environmental situation in cities. With the growth of a city and development of its industry, the problem of environmental protection and creation of normal conditions for human life are becoming more complex. These days people have a predominantly negative impact on the environment and, in particular, greenery. The decline in environmental indicators in conditions of compacted high-rise building cities initially associated with a decrease in the area of urban gardening. The solution could be the creation of mobile spaces, including gardens, squares, alleys, hedges or their individual components that can certainly be found in the city of Krasnoyarsk. The relevance of the topic considers the fact that landscaping and gardening of territories is one of the most important spheres of municipal economy. With the help of the sphere of municipal economy it becomes possible to create conditions which provide high standards of living. Thereby, conditions are created for comfortable and healthy life for both an individual and society as a whole.

The main objectives of this work are the analysis of foreign and domestic mobile green spaces and their division into types and subtypes, as well as the development of modern methods of formation of zones of ecological comfort in conditions of compacted land. Creation of mobile (movable) plantations such as gardens, squares, alleys, green fences or their separate elements, which can be practically applicable in the city of Krasnoyarsk, may become one of possible solutions.

Mobile landscaping is the landscaping of a city which is realized through design elements that can be implemented to move around, allowing the environment of the city to be edited, more diverse, heterogeneous, and interesting for the residents, and completely removable from the urban environment if it necessary.

During the process of studying of the current issue, mobile gardens have been divided into several types:

Type 1: Floating gardens

Floating gardens are a type of mobile gardens, standing directly on the water, for the purpose of growing plants and flowers on floating "islands" [4]. For example, the Swedish team of artists SIMKA designed the floating forest, which is swimming in the Baltic Sea since 2014. For creation of floating forests various types of wood from different regions, for example, birch and others, can be used. The purpose of the project was not only to draw citizens' attention to the environmental aspect of their work, but also to create a relationship between members of different communities.

Fig. 1. The "Floating gardens.

Type 2: Garden on wheels

Gardens on wheels are a type of mobile gardens that moves on wheels around the city, visiting public events, markets, various locations, and allowing people to learn about agricultural plants. Nowadays urban gardens are emerging in the most unexpected places. The bus looks like an eco-friendly transport, and inside may have a large number of different plants. The organizers of the project "The Green Urban Lunch Box" want to prove that in urban environments you can grow plants and get food. Inside the bus there are various tools with the help of which it is possible to grow field plants. The sunlight for growing plants is provided through the transparent roof. The objective of the project is the integration of people with disabilities and older Americans because the garden is the most suitable place for leisure and socializing.

Fig. 2. Garden on wheels.

Type 3: Parking gardens

Parking gardens are a mobile mini-park with trees and benches, which takes several hours on parking places at parking lots.

The action "Parking Day" was organized by the bureau of Rebar from San Francisco, whose employees arbitrarily transformed a parking place into a mini-park for 2.5 hours. As a result, thousands of people around the world repeated their experience, and in one day in many cities empty or underused parking lots were transformed into urban green dots. Among such variety a large number of unique miniature parks can be found. For example, the Temporary Park created by Studio Freight in Chicago. First of all, the unusual openwork structure created from used cardboard cylinders serving as a perfect miniature fencing of the park space from the roadway draws attention. The project also includes green plantings, seats made of the same cylinders, and handmade cardboard kaleidoscopes.

Fig. 3. Parking gardens.

Type 4: Portable gardens in containers

Mobile gardens of this type are characterized by the apparent ease of use and portability of containers. The technology is portable, simple, takes up very little space, and awakens interest in urban agriculture areas. As mentioned above major cities do not have

favorable environment for an agricultural activity. Despite this, the demand for fresh and natural products among urban residents is at a high level. Some people are engaged in agricultural activities in the countryside but quite often expenses do not allow such personal farming to be beneficial. A good example of this type may be the Administration in Berlin-Kreuzberg that supported a wonderful social and environmental initiative and allocated the area to create a mobile city garden Prinzessinnengarten. The project was launched in 2009 at the place that was abandoned for more than 50 years, and today the place has become a real paradise for growing vegetables.

Fig. 4. Portable gardens in containers.

Type 5: Mobile gardens

Mobile gardens are a mobile art installation of the garden. In 2003 in Seattle artists John Sutton, Ben and Zach Take Kaller designed a "Mobile garden". During the spring and summer the "Mobile Park" in the form of benches, a fountain, live plants (a tree, grass, flowers, shrubs) and stone-paved paths went through the city streets and invited passers-by to sit and relax on the bench inside this landscaped "green island".

Another example is Engen Meyer who is Dutch artist that creates urban gardens which can move freely through the cities. The main idea of her project is to unite people who loves plants but do not have the possibility to maintain their own garden because of living in an urban setting. For example, a simple cart is able to accommodate quite a large number of plant species, which can be looked after by the residents. It is easy to transport from place to place and park the cart in any municipal court.

Fig. 5. Mobile gardens.

Type 6: Gardens and parks on the street

Gardens and parks on the street are a type of mobile parks, which occupies the land that is not used for the intended purpose[6]. In Groningen a hectare empty space was turned into a micro-city, which became the center of development of creativity and business. All the buildings in it are temporary, so they can be disassembled at any time. Now there are about ten pavilions, cafes and restaurants, the children's area and the area for outdoor events.

In France in a vacant lot between the houses people made the urban stage with plants, furniture and art objects. People gather here for workshops, cultural evenings and just to spend time.

In the place of empty parking lots in Amsterdam, for example, people built a golf course. Nine holes and small lawns of different shapes were placed on the mini-box.

Fig. 6. Mobile gardens.

Thus, it becomes obvious that the improvement of the area with the help of mobile landscaping allows people to place the required number of square “green” meters on small patches of urban space. Well-placed mobile gardens, adding to the diversity of the urban environment, are able to fulfill utilitarian, aesthetic and sanitary-hygienic roles.

In conclusion, we can say that mobile gardens and parks have been used abroad for a long time. Mobile compositions of plants, gardens, parks, vegetable gardens as a method of landscaping can solve the problem of formation of a comfortable environment at the modern technological level, so the use of movable types of gardening is very relevant these days.

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УДК 621

THE DUTCH WINDWHEEL

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Energy makes a great contribution to the welfare of society, providing the areas of consumption, such as heating, lighting, cooking, and also energy provides the necessary resources the various branches of production and transport. This fact will lead to increase in pressure on the power supply system and it will require a lot of attention to energy efficiency. This energy problem of using efficient sources of energy is one of the major problems of humanity. Nowadays, the main sources of energy are gas, coal and oil. Scientists predict that oil reserves will enough for 40 years, coal for 395 years, gas 60 years.

And what will happen next? The world energy system has huge problems. Also, there are other kinds of energy, such as wind energy, solar energy, water energy and e.t.c. Despite the fact that scientists believe that by 2050 alternative energy sources will be the main, they have disadvantages. For example, solar energy requires large areas of land for building solar power station, what's more building materials are very expensive and inaccessible. With regard to the energy of the water, there are also its weaknesses. Because of building electricity power station there is influence on the climate, migration of animals, flooding the surrounding area.

Also, there are wind power stations, which widely used in Denmark, Portugal, Ireland, Spain and Germany. Despite the fact that such stations have many advantages (inexhaustible, availability, ecological) unfortunately, they have disadvantages too, such as noise produced during the rotation of the blades and danger for birds. However, there is a wind generator, devoid of these shortcomings.

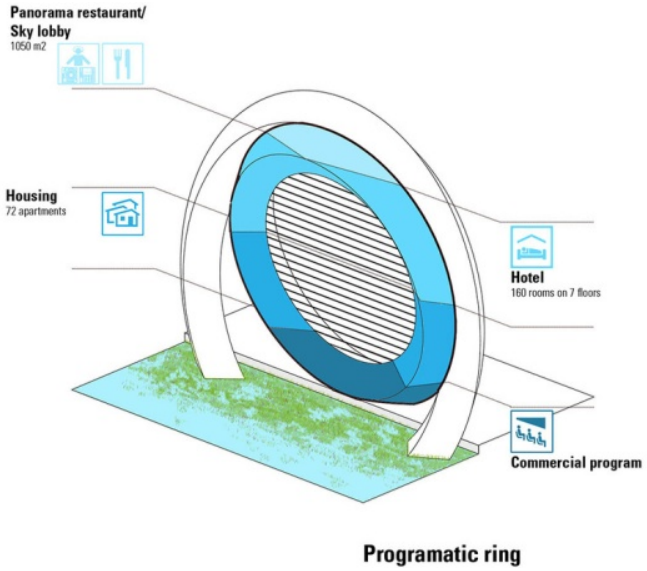

Fig.1

Wind energy is promising area of energy, due to the fact that wind energy content is more than 100 times greater than hydropower reserves of all the world's rivers. Necessity of working with wind power is obvious. Main task of scientists was getting rid of all disadvantages of wind energy and benefit from wind generator during no wind, because wind energy is unregulated source of energy. Scientists and engineers from Holland coped with this task. It comes to creating unique, innovative windwheel – The Dutch Windwheel.

Dutch Windwheel Corporation plans to build a wind power plant in Rotterdam Dutch Windwheel, whose work will be based on technology EWICON (Electrostatic wind energy converter), the essence of which is that the turbines convert wind energy into electricity by means of a skeleton of steel pipes, which have no moving parts. No noise. No spinning shadows. The new technology recently developed in Delft Institute of Technology.

The Dutch Windwheel is a full residential complex, combined with a huge windwheel. Construction of the Dutch Windwheel already has a lot of titles. This is the most innovation «windwheel» in the world, the most ecological source of energy and accelerator development of renewable energy. The Dutch Windwheel is future symbol of the Netherlands and future landmark of the largest European ports - Rotterdam.

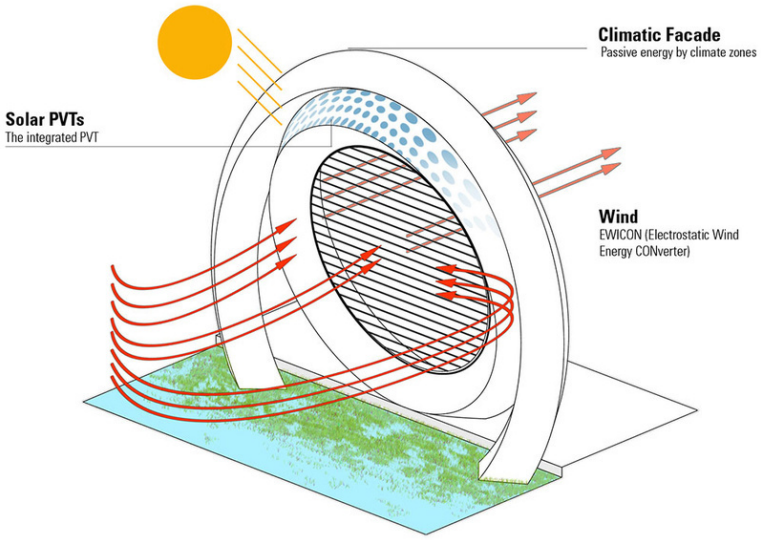

Fig.2

The EWICON technology was developed by a consortium including the TU Delft and Wageningen University in the context of government innovation program. This pioneering wind turbine converts wind energy with a framework of steel tubes into electricity without moving mechanical parts. Result: less wear, lower maintenance costs and no noise or moving shadow. This makes the Dutch Windwheel the most innovative 'windmill' in the world.

The technology EWICON is the motion of charged particles against the direction of the electric field. In the outer ring Dutch Windwheel role of such particles will perform positively charged water droplets. Using special nozzles scattered throughout the inner surface of the ring, these droplets will be lifted into the air, the wind blew into chase them along the electrodes, as dotting the inner surface. Due to this constant potential difference is created and produced an electric current.

The water will be extracted from the soil, which is around an innovative "water mill" will be swamped, including by rain, which will run down the outside curve of the Rings. This technology is good because in the mechanism of power will not be moving parts. This means that nothing will wear out and break. Its planned to heat the space in the building using biogas from organic waste.

In conclusion it is necessary to answer the main question - source of energy without the disadvantages is it possible? Yes, it’s possible and this article confirms it. There are so many source and kinds of energy, and it’s amazing, that progress came to such technologies. The Dutch Windwheel is truly a unique invention, devoid of any defects and performing so many features!

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YOUTH AND SCIENCE

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Carl Sagan once stated:«Every kid starts out as a natural-born scientist, and then we beat it out of them. A few trickle through the system with their wonder and enthusiasm for science intact ». Unfortunately,we all are effected by silly stereotype, whichhappens to exist nowadays that being scientist is dull and boringin modern life.This delusion unconsciouslyput boundaries on our point of view and blur our sharp vision. However, this is where the paradox suddenly comes up.

Eager to find out the basis of this stereotype, I did kindly ask some people from my social circle for their opinions and I was left withambiguous results. I asked them to think of scientist and when they try to get picture in their heads, it was either the old man with grey hair, thoughtful look in his eyes, wearing the glasses or man, also, wearing a glasses,but appear to be in his early twenties. If you did get an image that is differ from what is given above, that means your way of thinking is oppose to society perspective. Bringing out kinds of scientists, it is rather bizarre that portrayal of young man, studying science, has a place in our minds. Nevertheless, the truth is, it was inculcated to us by our society through countless movies and books with brilliant geniuses in it. The majority of them seems to be very young and nerdy. But still young and clever. So, One need only to look closer torecognize genuine drive and desire of youngsters to excel in the world and beyond. Andthis is exactly what sciencedesperately needs.More importantly, it is extremely necessary not to be hostages of public opinion and thoughts and be able to stand out of crowd. Once again,Carl Saganremarkably put it: «The fact that some geniuses were laughed at does not imply that all who are laughed at are geniuses. They laughed at Columbus, they laughed at Fulton, they laughed at the Wright brothers. But they also laughed at Bozo the Clown».

It is a precious privilege to find what you love in the begging of your career and carry out your work for the rest your life journey. Moreover, to make this complicated and tricky choice you have to have all options laying open. Our society offers great deal of opportunities to prove andbecome better version of ourselves. There are many programs thathelp young generation build themselvesas strong leader and inspiring human being. Programs were mostly made to cherish and expose hidden talents of young people, who are interesting in pursuing the career related to major scientific disciplines andresearches, so that they may make more informed choices for their future endeavors. Science is a driving force behind our sociocultural evolution. New ideas and new inventions are constantly redefining how we live our lives. Brand-new minds of new generation are perfect fuel for the development of our world.They bring new ideas, new strength, new force.

Needless to say that science is not just body of knowledge or an object of studying. It is way of thinking, the way of looking at things. It counsels us to carry alternative thoughts in our heads and see which ones best match the facts. It urges on us a fine balance between opening to new ideas and respecting the old ones. Science has changed how we think of the world while continuously changing the world we think about.

As time goes on, our day-to-day live becomesless natural,more artificialand fake. This is not utterly bad. However, it does raise the standards for what we must understand about how the world works. Failing to keep a basic understanding of science is destined to segregate the population and damageour fragile and unprotected nature. Without the essential knowledge of science we would not have the ability to read a book in the evening due to lack of lightning, we would not be able to travel by car or ship or even plane because we would not

be able to invent them, we would not know that we live in solar system full of another planets or that Earth revolves around the sun and its axis. Furthermore, we would not be able to help sick children or people in need. Science covers all aspects of our world. You may find the reflection of it in every detail that you look at or come across in daily life. You have the possibility to explain, deny or challenge the basic orsideline phenomenon. You have power to predict or even manage not only your life, but also everything around you.

Human kind faces complex and dangerous threats of the world. We were dealing with difficult issues ten years ago and we are still dealing with them now. The climate is changing. The earth is warming up, and there is overwhelming scientific verdict that it is occurring, and human-induced. Around the globe, seasons are shifting, temperatures are climbing and sea levels are rising, our wildlife nature is at risk, destructive storms becoming more powerful and damaging, more heat-related illnesses appear to have place.With global warming on the increase, chances for ecosystems to adapt naturally are diminishing.However, we still desperately need our planet to supply us with everything we must have due to survive. It isunreasonable andimprudent for us to remain ignorant about global warming or ozone depletion,acid rainand radioactive wastes, toxic. Jobs and wages depend on science and technology as well as strong health and carefree future of our grandchildren. The key to the successful solution is in science andfaithful devotion to it. Youngsters have every possibility to help this outstanding world heal by choosing to be part of spectacular, unique and mysteriousthing called science.So,becoming scientist is becoming a superhero in some way.

We have to raise an awareness of how important science is to everyone. It is in our duty to support and promote it. Especially, when young kids are taking an interest in such thing, we need to gather behind them as invisible shield and help on every step of their way. Many adults are put off when youngsters pose scientific questions. Children ask why the sky is blue, or what a sleep is, or why people do not fly, or how old is our planet, or why we have eyebrows. Too many teachers and parents answer with irritation or quickly move on to something else. Children soon recognize that somehow this kind of question bothers adults. A few more experiences like this and another child has been lost to science. Many of these children are curious, intellectually vigorous, ask insightful questions, and exhibit great enthusiasm for science. But as time goes by, wonderful children become teenagers going through the prism of reality and the fear of being judged. They are worried about asking dumb questions; they are willing to accept undue answers; they do not ask following questions.That is why we need to encourage them to strive for the greatest. But simple encouragements are not enough. We need to present them with tools and access to the source of knowledge and mind-blowing opportunities and make sure they know that anyone can reach high peaks. It is a haunted dream of mine that one day people would not be able to distinguish reality from the fantasy because those two points would merge as one.

Funnily enough, science has become multifaceted and extensive area of possessing the right awareness of certain things. «I am compelled to fear that science will be used to promote the power of dominant groups rather than to make men happy» said Bertrand Russell in his book «Icarus, or the Future of Science» in the distant 1925. In addition to, science does open many doors not only to self-education,but also tothe principles of world, secret processes, respect and honor from people around us. It brings personal satisfaction and smooth the burning argue to get to the main point of things.

Science in a way craving thirst of exploring the unknown in the world and beyond, which always demands to be investigated and learnt. There are no better candidate to propose a new hypothesis or find the answer to the twisted cases ofundiscovered then purposeful, ambitious and charismatic young man or woman. Science erase any differences between people. Moreover,it does not take into the account the color of skin, the gender, the nationality;it only cares about your brain, your inputand your thoughts on various topics. It

accepts youngsters for their mind, for who they are.It helpsyoung generation come out of theirrepulsive shell and live life to its true meaning. The only request isto give it a shot;try toperceive science not as the insane strange aspect, which cannot be breathtaking and capturing, butas something inspiring and intrigue. Try to see that science has a lot to offer and to give. It can be magnificent and thrilling, unexpected and impossibly gripping. The faith of the whole world is in hands of every human being, who seek themightand aspire for enormous puzzles of theenigmatic university. You can be the one making all the changes.

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NEW LAWS OF ROBOTICS

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The engineering of artificial intelligence (AI) attracts more and more attention every year. Large corporations such as Google and Apple invest in the creation of artificial intelligence. We understand AI as a mathematical model of the human brain, as multipurpose algorithm is able to create other algorithms for solving specific problems. Indeed when we will create digital intellect we will get an excellent assistant. Primitive forms of artificial intelligence, that exist today, have already proved their usefulness but humankind can create something that will surpass its creator. "It would take off on its own, and re-design itself at an ever increasing rate. Humans, who are limited by slow biological evolution, couldn't compete, and would be superseded", suggests Stephen Hawking.

It goes without saying artificial intelligence will be dangerous to humanity because of its unpredictable behavior. The topicality of our report is the derivation of the rules for creating AI. It should be noted that such rules already exist: this are three laws of robotics by Asimov. But these laws are difficult to realize in practice that is why they are often the subject of scientific criticism.

Today this problem is poorly understood and is not beyond science fiction because most people believe that the AI doesn't represent a threat to humanity. However, some of the world famous scientists as Elon Musk and Stephen Hawking want people to think about safety of technologies. It means that the development of rules for creating the AI is an important goal. In the future, our rules may be the foundation for new, more effective and laconic rules, we hope our rules are contribution to the development of AI and security for the mankind.

For the derivation of the rules we turned to the works of science-fiction writers, directors. Maybe it sounds not scientific, but we have some argument in favor of science fiction: over time, many sci-fi works have become a reality. Examples are shown in this table.

Table

Invention, event	Book where it was described	Year of writing a book	Year of creation
Landing of man on the Moon	" From the Earth to the Moon", Jules Verne	1865	Neil Armstrong stepped on the Moon; July 20, 1969
Portable system for immersion of Captain Nemo in Verne 's novel was a prototype of the aqualung	" Twenty Thousand Leagues Under the Sea", Jules Verne	1870	The first safe and effective apparatus for underwater breathing was invented in 1943
Robots	"Rossumovskie universal robots ", Karel Capek	1920	At the moment we have primitive forms of humanoid robots

The tablet computer is similar to the iPad with this galactic Wi-Fi access.	The Hitchhiker's Guide to the Galaxy", Douglas Adams	1970	Today we have a huge selection of tablet computer
Total chase of society	"1984", George Orwell	1949	Scandal in 2014: a huge number of people has been under surveillance by the US NSA

It happens because good science fiction is not based on pure fiction but on real facts and scientific hypotheses. We analyzed some possible scenarios of disasters related to AI. The goal of our rules isn't only to prevent disaster but keep out them at the initial stage - the artificial intelligence's creation.

During the work we considered the main scenarios of accidents and worked out some laws which could prevent them.

Scenario № 1

Analyzed movie is "Short Circuit" by John Badham, 1986.

AI sees a person as a threat to its existence because a person can turn it off at any time. In this case the survival instinct of the AI is activated. Then the AI attempts to break out of the human control. This outcome is undesirable because we create AI as an assistant that must obey. So in the film "Short Circuit" when the robot realizes its dismantling, it escapes.

The conclusion is the following we must have the opportunity to deactivate physically artificial intelligence (let's call it the principle of "a big red button"). AI shouldn't have access to this "red button" otherwise the protection mechanism doesn't have sense. Otherwise we should build our relations with AI on fear. But in our opinion it is not ethical.

Scenario № 2

Analyzed movies are a sci-fi thriller "The Matrix" by Wachowski brothers, 1999; "Terminator" by James Cameron, 1984; "Blade Runner" by Ridley Scott, 1982.

AI evolves quickly and surpasses us. Machines understand that they are better than human beings and perceive people as rivals in the struggle for limited resources. The outcome is clear: it is the war between robots and people.

Moreover in this case AI realizes that it is a servant and tries to escape from under the yoke. Robots can organize some acts of disobedience as artificial people androids in "Blade Runner" do.

The conclusion is the next: for the work that does not require specific intellectual skills it is necessary to use robots with a primitive system of artificial intelligence. You also need a mechanism to monitor the development of AI. It's quite a difficult technical task because AI can be "a black box" for us.

Scenario № 3

Analyzed movie is a short-length film "BlinkyTM" by Rory Robinson, 2011.

Some malfunctions in the program of artificial intelligence can lead to unpredictable consequences. AI can just get crazy. "BlinkyTM" demonstrates the consequences of such mistakes: due to the conflicting commands teenage robot goes crazy and kills boy's family.

The conclusion number three is AI must stop its program if there are any errors. But if we prescribe this condition in the AI code it can easily fix it. So again we are led to the necessity of "a big red button".

Scenario № 4

Analyzed movies are “I, Robot” by Alexander Proyas (created by the eponymous cycle of stories by Isaac Asimov), 2004; computer animation, sci-fi film “WALL-E” by Pixar Animation Studios, 2008.

We give AI the task to make all the people happy. Digital intellect quickly determines the root of the afflictions of people is people. AI does not have the necessity to kill people; it can just create the conditions in which people cannot hurt each other. AI tries to change the way society exists but we don’t know in what direction. This scenario is shown in the science fiction movie "I, Robot”: AI comes to a new understanding of the three Asimov`s laws and begins to capture humanity.

Another remarkable example of the AI’s influence on the human society future is the cartoon “WALL-E”. The robot-pilot of a spaceship prevents the return of people to Earth because it believes it is irrational decision.

The conclusion number four is we must formulate more precise targets for AI and have “a big red button” nearby.

Scenario № 5

Analyzed movie is a Spanish fantasy film “Eva” by Kike Maíllo.

If we endow AI emotions it can lead to instability of conduct. It may not be the impetus for the robot’s rebellion but probably it will be single cases when the robot harms a person. For example, in the movie "Eva" robot that has emotions pushed the woman with the rock in anger.

The conclusion number five is we can create AI without emotions, but it will lead to a new problem: digital intellect will select the solutions of problems that would be unacceptable to us because of the ethics and morality. Because we define for ourselves what is good and what is evil on the level of emotions. Also in the creation of AI emotions can be a byproduct in this case we need a strict control and suppressed emotions.

As a result of our research, we obtain the following rules for the AI creators:

1. Humanity must be able to deactivate the AI on the physical level, in other words, we must have “a big red button" to which artificial intelligence will not have access.
2. Humanity must have a system of control over the development of AI and the ability to restrain its self-development.
3. The presence of emotions is undesirable because it led to unpredictable actions. But it is worth of keeping in mind that the rationality without morality is evil.

So the creation of AI is a matter of time. We hope that these rules will make you think about the safety of new technologies because sometimes even the most unbelievable predictions can come true.

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УДК - 725.8

USE OF THE VENUES IN POST-OLYMPIC PERIOD

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The Olympic Games - are the leading international sporting events of the present which are held every four years. The tradition existing in Ancient Greece at the end of the 19th century has been revived by the French public figure Pierre de Coubertin.

For realization of such huge event, as the Olympic Games, serious investments are required. At the same time it is necessary to think over strategy of development of those grandiose projects in the future. This question is especially actual because of the XXIX winter Universiade in Krasnoyarsk. Subject of our research are the sports complexes constructed specially to opening of games, and the analysis of foreign and home projects of preparation for holding the Olympic Game. The received result is compared with strategy of future Universiade in Krasnoyarsk.

Considering some foreign Olympic complexes, we estimated them, proceeding from two major factors: how life of the cities hosting the Olympic Games has changed after their end and how Olympic projects were used afterwards.

Beijing, PRC - 2008 (XXIX Summer Olympic Games). Creation of image of the modern megalopolis and building of unique objects was the main task of the project of the Olympic Games in Beijing which attracted tourists. Over 40 billion dollars have been spent for development of infrastructure, transport system and ecology of Beijing (Games in Beijing became the most expensive Olympic Games for all world history). National stadium also known as the Bird's Nest is the main sports arena of games of 2008 and "one of the most outstanding architectural constructions of the 21st century". After the Olympic Games at stadium performance of global stars, the Italian football match, statement of the opera and musical have taken place, and quite recently the park of winter entertainments has been arranged there. Sports competitions are held not often because of huge spaciousness of the arena here: about 90 000 viewers. Absolutely other destiny has comprehended the Beijing National Aquatics Center. After competitions the object has been open for carrying out commercial shows. Though some pools of the Water cube are not working, water is pumped out for an irrigation of plants in the nearest national park from there. Besides, some gyms have been sent to the order of universities. In 2009 there was established a waterpark which wasn't planned before. It has considerably solved problems of operation of a complex: the waterpark not only has increased interest of tourists in Beijing, but also has resolved an issue of future of object. In addition, The Water Cube became a quite good brand.

However not all Olympic venues in Beijing have found the second life: some sports arenas and cycle routes aren't used and begin to collapse. Now the authorities are faced by a question of possible dismantle because of threat to curious tourists who aren't frightened by a critical condition of constructions.

Beijing has received essential inflow of internal tourists who have filled the Olympic Park. And rather convenient was an arrangement of two main Olympic arenas: from the Bird's Nest to the Water cube of all a couple of minutes on foot.

Vancouver, Canada - 2010 (XXI Winter Olympic Games). The Olympic village in Vancouver was erected on the southern extremity of the Coal Harbour waterfront which historically served as the location of key industries of the industry.

The main concept of the Millennium company which is engaged in the project of the Olympic village there was a skillful impregnation of open space in already existing housing

estate. In particular also such non-standard ideas as introduction of "vertical streets" with green plantings and effective uses of rain rainfall have been offered (washout of toilets and use in the sewerage). All felled trees (preventing construction) have been replaced. [1]

The inhabited residential district in Coal Harbour independently develops annual amount of energy necessary for him. Besides, the Coal Harbour is quite well adapted for foot and bicycle walks.

The Main Olympic arena, the Olympic oval of Richmond – is the most striking and qualitative example of the thought-over heritage. Local authorities of Richmond understood that development of skating would demand serious investments. For this reason the Oval has been transformed to the large fitness center consisting of several sections. Also they haven't forgotten energy saving. So, rain water from a roof of the building is used for discharge in toilets and for irrigational works, and heat received by ice preparation is directed to heating and heating of water, including in the buildings, neighboring to a complex. Richmond Oval is nominated for "The silver certificate" of LEED (Leadership in Energy and Environmental Design. (The Olympic center of Vancouver got "The gold certificate")

Vancouver has shown an excellent town-planning example of the future, with the "green" concept of the majority of the constructions. Investments in development of speed skating have been justified: The Olympic oval of Richmond enjoys wide popularity.

London, Great Britain (XXX Summer Olympic Games). The Olympic complex has been constructed around the industrial zone polluted by the enterprises. Before construction the city has carried out unique operation on cleaning of the territory during which channels have been cleared, the soil and the garbage is taken out. Remembering that the majority of Olympic venues in the different countries remain abandoned, the city hall has decided to use the Olympic Park as city one that significantly would help to revitalize east districts of the city and to attract investments [2]. The solution of a transport problem of east district of the city - Stratford became the following obvious plus. New branches of the subway have connected the East of London with the center and the main transport network, having reduced time on the way.

The Olympic village became not only the new residential quarter, but also part of the program of social housing for military and veterans. Also here all conditions for accommodation of handicapped groups of the population are created: new movie theater, supermarkets, the reconstructed theater – all this is equipped with attributes of barrier-free space.

After the end of Games it is possible to refer the works which are carried out in the Palace of water sports to the main reconstruction of Olympic venues: visual stands and the number of pools have been reduced to reduce costs of operation.

It is obvious that developments of east part of the city and improvement of the environment in general became the main acquisition of London after holding the Olympic Games. Even if the Olympic Park didn't become the tourist center, it still is the favourite place of walks of locals.

Moscow, USSR – 1980 (XXII Summer Olympic Games. Due to the expected flow of foreign guests it has been decided to build the separate international terminal of the Sheremetyevo airport.

For accommodation of athletes in the southwest of Moscow near Michurinsky Avenue the Olympic village - in fact, the improved standard area of panel houses with the equipped apartments, shops and ready infrastructure where at once after the Olympic Games Muscovites have moved into has been built. Now it is, probably, one of the largest hotel centers of Europe [3]

Before the Olympic Games the Central stadium of V. I. Lenin, the present main arena of a sports complex Luzhniki have been reconstructed. Besides, the universal gym "Friendship" has been constructed for the Olympic competitions

The area of the Olympic village is unique because of the the fact that firstly it was created for placing the arrived athletes, and secondly - in order to settle a great number of Muscovites after the Olympic Games-80. That is actually built capital housing, but not temporary constructions. In heritage from the Olympic Games-80 till today's moment the main sports arenas Luzhniki and SK "Olympic" have remained which are the central sports arenas of Moscow now

Kazan, RF - 2013 (XXVII Summer Universiade). Generally sporting venues in Kazan remained are open for free visit. In the pool "Bustan" and the sports center "Moscow" which belong to the Kazan Federal University (KFU) classes in physical culture are being giving for all comers.

The village of Universiade and before student's games was the hostel of KFU for junior students. But after Universiade less than in two years to the village more than 15 000 new students have moved into. In addition in the city there were also new outcomes which have helped to unload roads of Kazan.

Also in Kazan to Universiade new parkings which have shown the inefficiency in connection with difficult procedure of payment and lack of identification marks have been built. The historical district of Kazan, the Old-Tatar settlement — has received a new pedestrian street of Kayum Nasyri. Houses have been restored, now they work as the museums, shops of antiques, restaurants and cafe. However there was an unresolved problem with the cars parked on a pedestrian street.

The separate word is deserved by the Olympic village which has taken over the Kazan university: features of the existing infrastructure and closeness of space for strangers turns the village into the city in the city with traditions, characteristic only of this place, and practicians.

In spite of the fact that the main stadium of Universiade — "Kazan arena" — wasn't opened, the world student's games have exerted extremely positive impact on the image of the city in general and on the student's center in particular.

Sochi, RF – 2014 (XXII Winter Olympic games). The Olympic Games in Sochi have been urged to create the resort of the international level for involvement of vacationers not only from regions, but also from abroad. Sports constructions have been constructed in two main clusters: Olympic Park and Krasnaya Polyana. Proceeding from geographical features of an arrangement, the following strategy of the post-Olympic development have been chosen: Krasnaya Polyana located in a massif became the mountain resort for the tourists loving extreme sports. Whereas the Olympic Park has been adapted for a housing estate and a coastal strip of rest [4].

The Shayba Arena which has been transformed to "The State Children's Health Improvement Center" is one of qualitative examples of the post-Olympic use. Furthermore, one should not forget about the alpine ski resort "Rosa Khutor" which became extremely demanded mountain complex. The only moment is that in the summer it loses the popularity as this aspect of the question isn't worked not up to the end out.

Experts have noticed that the Olympic Games in Sochi have been held at the high level, logistic nuances (a convenient arrangement of recreation facility and the training centers) are considered, but not enough attention is paid to conservation: for example, the Mzymta River where there was a spawning Black Sea bull-trouts (Red List) has lost fishery value, and the cut-down trees haven't been restored.

Analysis of Krasnoyarsk

The project of Universiade of Krasnoyarsk means the following transformations placement about 20 objects of the Olympic value in the territory of the city, reconstruction existing and improvement of infrastructure. The priority direction of development is the air and railway transport as the main way of arriving foreign guests. Therefore, the design decision has provided construction of the new passenger Yemelyanovo terminal, and also reconstruction of surrounding space, revision of logistics of management of passenger traffics, increase of overall performance of a runway, etc. Among the list of capital construction projects there are four look: sporting venues (11 competitive and training objects), objects of the Village of Universiade (housing estates "Feathers" and "University", multipurpose center), objects of medical and transport infrastructure.

Changes will concern also city public transport. For him will allocate separate lanes on the main streets and some restrictions for an individual transport will be introduced. Construction of the catching parking on Oktyabrskaya Street is already now carried out, and also construction of such parkings on streets of Red Army and Mayerchak prepares. It is in addition planned to equip the guest route on the fourth bridge through the river Yenisei: to secure her by means of additional lighting and to add effective outcomes.

In October, 2015 on a right bank of Krasnoyarsk, have begun construction of the multipurpose sports and spectacular complex "Platinum Arena" in which there will take place ice hockey competitions. The ice arena will be able to accept up to 7 thousand viewers at the same time. After Universiade are planned to carry out competitions and trainings on hockey, figure skating, short track, mass skating, and also cultural and entertaining actions here. It is possible that the new ice arena after Universiade will become the home platform of Krasnoyarsk hockey club "Sokol" [5].

Other new object designed to Universiade is the sports and training complex "Academy of Winter Sports" will accept freestyle competitions, to a snowboard, cross-country skiing and sports orientation. The complex will consist of the sports and trainer's Mountain block, sports clusters "Hill" and "Rainbow". What is important, the question of necessity of the developed sports infrastructure on the Nikolaev hill isn't even raised, this event has being waited many years. Uniqueness of Academy's route is that it is suitable not only for professional sportsmen, but also it is absolutely safe for beginners.

Feature of the project of preparation for Universiade of Krasnoyarsk is reconstruction existing arenas which amount more than half part of Olympic venues [6]. It will allow to improve already demanded objects, but not to think out appointment for new ones. In addition, objects that will become sports arenas in 2019 settle down not on one platform, but in different parts of the city. It provides relative availability to locals in the future and uniform development of certain areas. Also it will make government develop city infrastructure.

Though construction of some constructions requires deforestation (from 15 to 26 thousand), but as writes Ministry for Protection of the Environment and Natural Resources of Krasnoyarsk Krai "compensative transplanting of trees at demolition of green plantings will make a ratio 2 to 1". It will allow to avoid the environmental disaster.

At the moment it is possible to predict several important consequences: there will be positive changes to the main problem of Krasnoyarsk – infrastructure; the entertaining sphere get several big complexes which will allow to attract not only Krasnoyarsk citizens, but also the population of Krai in general.

Practical application of successful decisions

From the analyzed examples of foreign and home projects we have decided to select the following decisions which can be used in Krasnoyarsk:

1. Creation of a brand. A brand is what is on sale and remembered. It can be as well as more global (Russia is represented by St. Basil's Cathedral, the Kremlin), and the certain city (an example of Beijing and the Water Cube). Of course, we have a brand of

Siberia which is known around the world. But it is necessary to advance also Krasnoyarsk. Stolby, Ergaki, Kommunalny Bridge, the Museum of Surikov and others may become the face of the city.

2. World green trends. Attention to the ecological part of construction is not only a tendency of the last years (Vancouver 2010), but also the only correct approach to the concept "sustainable development". It is necessary to conserve nature resources for future generations. Moreover, green design makes healthier an urban environment and enhances the townscape. The public in general tend to believe that compensation of the cut-down trees in double amount is only a beginning of "green" practice in Krasnoyarsk.

3. Analyzing demand of citizens. There is no need to build «white elephants» which duplicate functions of each other. It makes sense, to reconstruct venues according to interests of citizens as soon as possible ("The Water cube" became a waterpark, the Olympic village in London – the residential quarter with city park).

4. Multifunctional venues. There is no need to create a construction with the unique function The Bird's Nest in Beijing) when it is more rational to project multipurpose space which is possible for quickly remaking after Universiade closing.

5. Creation of effective infrastructure. Problems on roads are one of the factors interfering attendance of objects. Situations when access to arenas is provided only for Games aren't rare, and after it considerably becomes complicated (In Sochi have cancelled the aeroexpress train in the airport). Fillability of objects directly depends on residents of all city, but not on one area.

6. Forecast future use. Ideally each project at early stages of concept has to have the plan of its application after completion of the world Games (Prison in Lake Placid). But it is never too late to make it: for example there can be held competitions among students on drawing up the project of reconstruction.

7. Motivation of citizens. Municipal government should offer different types of motivations, from moral encouragement (diploma) and till monetary (grants) for cleaning of the city and facades. The last point concerns mostly businessmen whose trade pavilions are located on the first floors of buildings of the red line.

In conclusion there is a wish to note once again that the Olympic complexes and objects of Universiade are a heritage which remains in possession of the host city. For this reason it is necessary to project taking into account not only requirements of the IOC and FISU, but also in view of needs of locals. The same treats ecology of sites: respect for the environment helps to keep natural resources and health of the population. Certainly, Universiade will promote a development of the city, a university campus and so on. As they say, "the soul of the city is concluded in its architecture", and depends on us as Krasnoyarsk in time and after Universiade will look.

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ECOLOGY OF KRASNOYARSK. IS IT POSSIBLE TO IMPROVE IT?

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If I ask you a question: “What should we do first to improve our life style in Krasnoyarsk?” I think the answer is obvious. It is ECOLOGY! Now we can only imagine and dream about permanent blue sky, about clean air, and our precious health.

I have an opinion about some decisions that can help our city to reduce environmental footprint. Below you will find 5 main proposals that people offer. I think they can have the most powerful effect. These ideas may seem distant, weird or radical. Vladimir Borisovich Kruglov (Candidate of Physico-Mathematical Sciences, professor) will help us to look at the proposals from the standpoint of the expert's thoughts.

1. Frosting of the Yenisei river downstream from the Krasnoyarsk hydroelectric power station (in winter).

I heard this variant on TV show some months ago. The main topic was “the Krasnoyarsk ecology”. One of the guests described some not so expensive ways to solve our urgent problems, for example: saving the original ecosystem of the Yenisei river, decreasing air humidity, and possible construction of ice roads for special adding alternative winter ways.

Expert opinion: “This idea is not real. I think it can be very expensive and hard to implement. I have never met such projects in my life.”

2. Government support of people (in Krasnoyarsk region) who have health problems because of adverse weather conditions.

I think our local government should be responsible for the ecological situation in our region. That is why it should help the disabled people, elderly people, especially those who have diseases of the respiratory organs. In my opinion, the government could give them free medicines to help people to avoid the consequences of adverse weather conditions.

Expert opinion: “Distribution of free medicines is very difficult because of a deficit budget. At least for now, by the reason of crisis situation.”

3. Tax breaks to individuals and legal entities that use alternative energy sources and renewable energy sources.

We suppose that we will have to go to secure energy sources in future, and this way is inevitable. Why can’t we support good ideas that would change our lifestyle?

Expert opinion: “This way is real. But I do not know any commercial companies in Krasnoyarsk which would only use environmentally friendly energy sources. I think they may appear after giving tax breaks.”

4. A restriction on the use of vehicles during the adverse weather conditions.

Some people may find this proposal as a restriction of their rights. But it is more important to protect the citizens’ interests that live in the city than interests of one person or a small group of people.

According to statistics, in 2014 the total number of citywide carbon emissions from vehicles amounted to 33.2%. This percentage is quite significant, and if we cannot avoid adverse weather conditions especially in the winter seasons (when CHP (combined heat and power plants) – one of the main pollutants – cannot reduce their emissions significantly), we should not use our private vehicles. We should also understand that using public transport is better for the environment.

I have recently interviewed my groupmates and only some students (a third of 25 people) are ready to use public transport instead of private vehicles (Fig.1). That probably

means that we are not clearly informed about the influence of carbon emissions from vehicles on our health.

Fig.1 Interview data

Expert opinion: "This is a good idea. A restriction on the use of vehicles can help in some cases. In different foreign countries the government ordered drivers to leave their cars at home on alternating days based on odd- or even-numbered license plates. It was a great success to introduce this innovative method."

5. Introduction of different programs which are connected with the disposition of some plants in Krasnoyarsk.

It is quite difficult, expensive and time-consuming to move our plants outside the city. But, if our local government and citizens want to live in a clean city in the future, we have to make all possible efforts and create legally binding projects. We should think about special zones outside the city to place there some plants which are relatively or completely suitable for them.

Expert opinion: "This is a difficult question. The main biological contaminant in Krasnoyarsk is the KrAZ plant. It is difficult to move this plant outside the city because the company should invest a lot of money into transportation of equipment, people and construction of new workshops. It looks almost unreal.

In my view, the gasification of plants of Krasnoyarsk region is the most reliable way to improve the ecological situation in our city. But probably our country just will not have enough gas volumes to import it and transport it to the regions at the same time."

In the end, I want to draw a conclusion that our environment can be better if we work together. We should not wait for the actions from officials, it is necessary to start with yourself. Short analysis of the ecological situation in Krasnoyarsk shows that the surest way to improve it is to reduce carbon emissions from vehicles and gasification of plants.

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STRAW-BALE CONSTRUCTION

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Today there are many types of constructions made of different materials; we are going to consider straw-bale construction, the most environmentally friendly type of building. A healthy environment is necessary for human and animal life to survive. People cannot maintain a desirable standard of living without the consumption of natural resources, which causes damage to the environment. In addition, using natural resources reduces their availability, which can lead to shortages of building and manufacturing materials, food, and water.

The problems concerning environment, natural resources and social conditions appeared by the end of the XX century and demanded searches for essentially new ways of development. Therefore, the idea of agricultural waste usage as construction material showed the prospects.

Straw-bale construction defined as a building method that uses bales of straw (wheat, rice, rye and oats straw) as structural elements was studied by Myhrman, Matts, MacDonald, S. O in his work «Build It with Bales», Shirokov E.I. in the work «Ecotechnology of the biopositive protecting designs from straw bale». The Canadian Financial and Construction Corporation have carried out a series of tests, which have helped to find out degree of reliability of straw houses. For demonstration of the experiment a wall has been built from straw bale 2,44 m high and 3,66 m long, it has been covered with plaster.

This subject has a great interest for our research as the theme of natural resources solving environmental and economical problems, is one of the most important issues nowadays. To investigate this theme first of all we studied the information on history, construction methods, advantages and disadvantages of construction made of straw-blocks developed by different authors. Then we did our conclusions about benefit of such constructions in our conditions.

First straw houses have been built on the African plains since the Paleolithic Era. In Germany, straw bales were used in construction 400 years ago; also straw-thatched roofs have been used in northern Europe and Asia for a long time. Indian tribes in America insulated wigwams in winter with loose straw between the inner lining and outer cover.

A new era of building out of straw and grasses began in the United States, in the late 1800s with the mechanical hay baler, which was invented in the 1850s and was widespread by the 1890s. This made possible to compress hay and straw into string or wire-tied rectangular. It proved particularly useful in the Nebraska. Homesteaders decided to use straw as a sustainable building material there, because straw is a large "waste" product from the agricultural industry. The first documented use of hay bales in construction in Nebraska was a schoolhouse built in 1896 or 1897.Unfortunatle it was unfenced and unprotected by stucco or plaster, and eaten by cows in 1902.

The first buildings were under construction without any framework because of deficiency of wood. The weight of a tent roof extended on walls was made of straw bales.

This equipment widely extended in Nebraska and was used till 1930. One of such houses remained till this day and it is used directly.

Some period of time straw-bale building was unfashionable with the availability of building materials and improved transport system. Last ten years humans become more environmentally aware so the interest to straw-bale building has a huge comeback.

The idea of building constructions made of straw bales existed in minds long ago sometimes it was invented anew and modernized. Separate experiences of straw construction were undertaken in different places.

Architects became interested in straw houses from the beginning of the 80th years. The magazine «National Geographic», the «New York Times» and TV supported revival of construction made of straw bale. Soon the construction made of straw houses extended worldwide. Houses have been built in the different countries and in the most various climatic zones: in Canada, Australia, France, Chile, Mexico, and in the USA. More than 150 buildings had been documented by 1994. In Russia, the first house made of straw bales was built in 1994 in the village Mayak near Chelyabinsk.

There are two types of straw bale constriction techniques: frame and frameless. In a frameless method, bales are used to support the weight of the roof. This technique often uses steel rods through the bales for reinforcement and stability from movement. This method has its own advantages, firstly, simplicity of construction, secondly, low cost. Use of blocks for support of a roof weight, imposes additional requirements to roof structure and its weight, and to density of bales. Usually the house has one story and simple design.

Frame method means that bales are used as "infill", like insulated wall material between the studs of a wood framed structure. The frame and not the straw bales support the roof. Structures can be architecturally more complex and larger.

Straw walls are covered with plaster. It protects straw bale from water, fire, rodents and other wreckers. For example, clay solution can be used as plaster. The block is dipped for a short time in rather thin solution of clay for treatment before usage. Such technology gives advantages in the accuracy of geometry of walls and fire safety, but walls turn out heavy, also walls can become moldy in wet weather conditions.

Besides, there is one more frame method of construction. It is assembly of the house of straw panels. Straw panels consist of a wooden framework in which straw is pressed densely. Advantages of such technology are that straw does not sink under roof weight any more, and the house is assembled on a site for several days.

Straw houses have a number of advantages, in comparison with houses from any other construction materials.

First, straw-bale walls are made of waste products. Once the edible part of the grain has been harvested (such as wheat or rice), the stalks often become a disposal problem for farmers. By bailing the straw, a new life is given to the material. The farmer makes some money by selling the bales and the homebuilder gains an excellent insulation and building material.

Second, straw bale walls are at least eighteen inches thick. This adds aesthetic value to the home as thick walls are expensive to achieve with traditional construction. The thickness of the wall helps to reflect sunlight throughout the room.

Third due to the thickness of straw bale walls, every window can have a window seat or shelf. This becomes both an aesthetic and practical design element.

Fourth, low price of the pressed straw (is 1000 times cheaper than a brick), the walls aren't demanding the powerful foundation and have significantly lower labor costs.

Then even novice builders easily understand the concept of straw bale construction. Under supervision of one knowledgeable straw bale trainer first-time builders can fulfil the construction process.

Straw bales have a low-embodied energy. This means that very little energy was used to manufacture the product, as sunlight was the main energy source for growing plant. The only energy needed to make a straw bale the bailing process and the transportation to the worksite. Other insulation materials, such as fiberglass require a substantial amount of energy to produce.

Straw bales are 100% biodegradable—when the time comes. Straw bale homes can last over 100 years if properly maintained. At some point, all structures will be eventually replaced. When the time comes, the straw bales can be plowed back into the earth.

Straw bales are a satisfactory insulation. Thermal conductivity of the walls is much lower, than walls made of traditional materials. Thermal conductivity of straw is 4 times lower, than that of a tree, and 7 times lower, than that of a brick. Straw-bale insulation is the most effective in climates where heating or cooling of the home is essential for comfort.

Straw bale walls can be carved with a knife or chainsaw. Openings around windows or doors can be made as you want. Bales can also be finished to a sharp angular edge. Niches can also be carved into the bales.

Despite what might seem logical, properly constructed walls made of straw bales have proven to be more flame retardant than conventional wood-frame construction. This is because the bales are dense and tend to just smolder when the ignition source is removed.

Straw homes can be beautiful as the natural material lends itself to multiple architectural styles.

And at last straw bale have higher elasticity in comparison with cement, bricks or stone consequently, they are less dangerous in case of an earthquake.

On the other hand, we can observe that straw-bale construction have some disadvantages.

The risk of fire is still equal to any other building material.

Construction demands careful observance of technologies and measures of fire safety because process of construction is very fire-dangerous.

Rotting. Straw with humidity more than 20% starts growing moldy therefore it is so important to hold straw-bale dry prior the construction.

Mice can lodge in straw in search for feed and heat. They cannot lodge in straw blocks, but they do it in emptiness between the bales. By the way, rodents are not the only small wreckers who can spoil straw house. There are birds and insects that can choose straw as the place for dwelling.

For the internal cladding of the house, it is impossible to use the materials, which bales steam traffic (cement plaster etc.).

To draw the conclusion, one can say that the straw-bale construction method is perspective type of construction. In the modern world there are problems, which concern environment, natural resources and social conditions, and construction from straw bales is the decision for many of them. This method is eco-friendly and is inexpensive in realization. Houses from straw are rather strong and durable; buildings in the State of Nebraska serve as confirmation to it. These buildings are nearly hundred years old, but all of them are still in an excellent state.

Houses of straw could be built in various climatic conditions. Hundreds of ecohouses have already been built in America, Canada, Australia, France, Chile, Mexico, Russia, etc. It should be noted that recently the ecohouses have been built in the city of Krasnoyarsk. According to the estimate of official source, the construction cost approximately 750 thousand rubles. The sum included construction of the brick furnace and distributing of water in the house. The considerable part of money was left on internal finishing of the houses.

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EVOLUTION, MODERN PROBLEMS AND WAYS OF INNOVATION KRASNOYARSK CITY WATER SYSTEMS

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This topic was taken because of huge troubles in water systems not only in Krasnoyarsk, but also in Russia at all. In this review we are trying to watch how Krasnoyarsk water system grow, consider modern troubles, what is made to solute problems and development directions.

Water is the main condition for the Earth's life. Therefore, water supply has become the defining factor of city's appearance and growth. Famous Russian geologist A. K. Karpinsky said that water is the most precious resource: "Water is not just a raw material or tool for our development, it is culture provider, it is blood, which makes life around itself"

The history of the Siberian water supply started almost at the same time with the Siberian development. Winter houses were made near some water sources such us lakes or rivers.

While Siberian city was growing, it was passing several stages of evolution: military base, trade center, center of manufacturing, occupations and trades.

Firstly, when the colonies were temporary, there was no water quality control. The main purpose of water supply was to find the nearest source of water. That happened because of the Russian government. The government did not worry about any nature condition. They concerned only about war and development purposes of towns.

This resulted in big troubles with water. In some towns, there was a lack of water, which could be drunk, and some towns were regularly flooded. Eventually they were moved from one place to another, but always stayed in the same district because of the Moscow's requirements.

Generally, when people became to choose new places more responsibly and build them according to the plan, there were no problems with water supply.

Water intake was realized just by taking water to the city in big cisterns. If city was rich, citizens could construct special engineering devices to provide water from river or lake to their homes. Water pipes were bonded with internal conduit, which was bonded with moats and water outtake channels.

Nevertheless, the most commonplace of water intake was wells. They were almost in each village. It is explained by a big amount of underground waters and low deep of their location. All these reasons let people get water without using difficult engineering systems.

At the end of the 19th century, there were many water problems in Krasnoyarsk, which were bonded to the lack of water conduit.

First of all there was a trouble with a water intake. Water was gotten only by two sources: either from cisterns, which were taken from river, or from wells. That was not enough to save Krasnoyarsk from a possible fire. Citizens were very concerned about this because of the terrible fire, which destroyed a significant part of Krasnoyarsk in 1881.

Another water problem was sanitary norms. People could safely drink water only from the main city well.

In 1910, the government head Smirnov P.S. established a decree to construct a water conduit. The building cost was 750 000 ₽. The citizens decided to make project by themselves. The construction was made by «Neptune» company, and all building works were managed by Gecen B.Y.

The filtering part of the city water supply system was built at Posandniy Island.

In 1912 the construction of dug well for infiltration water intake was started. There also were installed radial flow pumps, which were able to produce 295,000 liters per hour.

In March 1913, culvert was laid to the city through the Martovskay channel. Soon firefighter's crew showed citizens the advantages of the city water supply system by making a water show.

In January 1914, the mayor ceremonially opened a water channel. Krasnoyarsk water supply system was able to give 2,460,000 liters per day, and the city was fully satisfied.

Nowadays the quality of Krasnoyarsk water is very high, it is proved by independent labs and by prizes in degustation competitions.

Unfortunately, the condition of water supply system is awful. A big amount of systems was made in 1960-1980. In addition, the city has already expended their sources. The wear of the water intake system consists 70 %. The wear of the water out take systems consists up to 80 %. Moreover, these indicators will be growing in future.

This situation is aggravated by the regular growth of Krasnoyarsk. There are always some new buildings, which are increasing a stress on the water supply system and are in need of building the new ones to connect. The water supply system demands more pumping works, water reservoirs and booster stations to the high-rise buildings. New grubs are needed to provide water to these new buildings.

Meanwhile there is not only necessity in water supply. Water disposal system is required too.

Another problem of water systems is energy demands. To date, the city water system is one of the biggest users of energy in Krasnoyarsk. Outdated technologies are not thrifty at all and spend too much energy to their needs.

To solve these problems Krasnoyarsk Company "KrasKom" with the aid of the Russian government worked out the project "Clean water", which is successfully realized in the region. The Program Purpose is to satisfy citizens' needs in drinkable water, modernize systems of the water supply and the sewer, safe clean of spring sources.

The project consists of several tasks:

To renovate the water intake system at Verhne-Atamanovskii Island. This step lets us decrease the energy cost of water production, give capability to deliver extra water of high quality.

Renovation of left and right side sewages disposal works. Because of the new city districts the volume of wastewater is increasing every day. The upgraded system will be able to withstand them.

To build and renovate the sewage pumping stations and sewer conduits on the both banks of the city. This measure will help to provide water in and out of the new buildings under construction and automation existing sewage pumping stations.

New kilometers of water supply system and water booster systems will be constructing to plug in the existing buildings and new ones.

Nowadays most developed countries make the emphasis on ecologically friendly and saving technologies. Water systems will be improved too. People are concerning of the lack of potable water, its recycling. There are some new technologies, which will reform water systems in near future.

Membrane Bio Reactor is used for recycling gray water (lightly polluted wastewater from bath, showers, wash hand basins and laundries). After recycling this water is able for people needs as non-potable water. Firstly, water is got pre-treated to delete coarse pollutants, and hairs. Then it gets into a tank, which ensures uniform feeding to a membrane plant. The heart of this plant is Membrane Bioreactor. This way of recycling removes not only solids, but also bacteria and germs.

Sewer water is almost unused nowadays. For nothing because of the new technology, which used this water to get heat. Mostly the temperature of sewer water is ranging from 10 °C - 20 °C dependent on the season. This is a good opportunity to make heat pumps and get some heat from it. However, to do this some preparations should be done.

Specially designed heat exchangers which are robust, free flowing and fully automatically self cleaning.

Prescreening to remove hairs, fibres and large solids.

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УДК62-529

INDUSTRIAL ROBOT MANIPULATOR

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The term robot stems from the Czech word robota, which translates roughly as ‘dull, repetitive labour’. Although robots are indeed often associated with performing highly repetitive, routine applications, today’s flexible automation technology lends itself to much more than that, undertaking sophisticated precision tasks that a human cannot hope to emulate. But to understand quite what applications the technology is capable of and where it might be integrated into your own production processes, it is important to appreciate the anatomy of a robot, or more accurately an industrial robot, since that governs its functionality.

Let’s start by defining an industrial robot. It is usually described as ‘a reprogrammable, multifunctional manipulator designed to perform various automated tasks’, to which the ISO standard adds that it must be ‘programmable in three or more axes’. To make more sense of that, we need to consider a number of core terms that describe the robotic anatomy.

Axis/axes – an axis is a line across which a rotating body turns. Two axes are required to reach any point in a straight plane, while three axes (X Y Z) are needed to reach any point in space. Three further axes (roll, pitch and yaw) are needed to control the orientation of the end of the robot arm or wrist.

End effector – also known as end of arm tooling, this is the ‘hand’ attached to the end of the robot arm or wrist. End effectors include grippers, vacuum cups, spray guns, welding tools and electro-magnetic pick-ups, their performance being vital to precision and repeatability.

Degrees of freedom – this is the number of independent movements the end effector can make along the axes of its coordinate system. For example, movement along the X Y Z coordinates only constitutes 3 degree of freedom, whilst adding rotation around the Z axis equals 4 degree of freedom.

Degrees of mobility – while degree of freedom are often incorrectly determined by simply counting the number of independent joints on the robot, this is more accurately expressed as degrees of mobility. Thus, an industrial robot has a maximum of 6 degree of freedom, but might actually have, say, 9 degrees of mobility.

Kinematics – is the actual arrangement of joints/axes and rigid links in the robot, as well as being the study of motion in robotics. Common robot kinematics, or configurations, include Cartesian, Articulated, Parallel and SCARA.

Manipulator – this refers to the arm mechanism, created from a sequence of joint and linkage combinations, including the wrist. Confusingly, it is often used to describe the robot itself, minus the power supply and controller.

Joints – robot joints are described as either rotational or translational. Rotational joints have a rotary action along the joint axis and are also referred to as revolute. Translational joints have a linear or sliding motion along the joint axis and are also known as prismatic.

Actuators – also referred to as drives, these are devices that convert electrical, hydraulic and pneumatic energy into robot motion. Nowadays, actuators are typically fast, accurate AC servo drives, while the robot base rotates using a harmonic drive or, less commonly, ring gear.

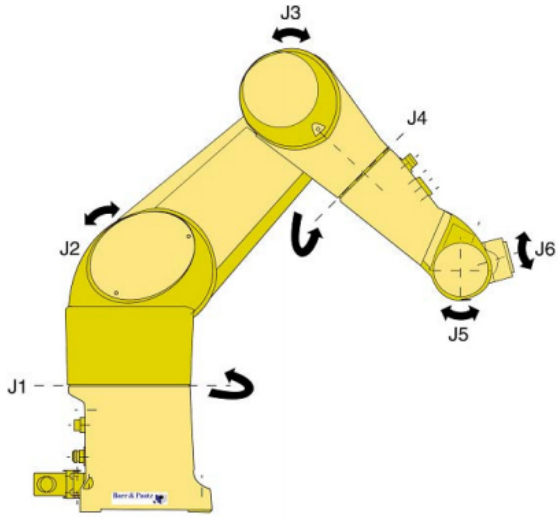
Work envelope – this is the total volume of space that the end effector of the manipulator can reach and is also known as workspace and work volume. The size and shape of the work envelope is determined by the robot kinematics and the number of degree of

freedom; it should be large enough to accommodate all the points the end effector needs to reach.

Having got to grips with the anatomical terms used in connection with industrial robots, we should next consider the operating and performance parameters against which any particular configuration and type is specified:

- Payload (kg) – maximum load or carrying capacity, including weight of the end effector.
- Reach (mm) – the maximum distance a robot can extend its arm to perform a task.
- Speed (mm/sec) – how fast a robot can position its end effector or rotate an axis (deg/sec).
- Acceleration (mm/sec) – defines how quickly an axis can accelerate to top speed.
- Accuracy (± mm) – how closely a robot can move to specified place in the work envelope.
- Repeatability (± mm) – how precisely a robot can return repeatedly to a given position.
- Mounting – robots can also be ceiling or wall mounted, freeing up effective workspace.
- Footprint (m^2) – installation space required, often minimised by overhead or wall mounting.
- Cycle Time (secs) – cumulative time for completing one full set of process operations.

Articulated robot – or Jointed Arm robot, is the most versatile type and closely resembles the kinematics of the human arm. It has three concurrent prismatic or rotary joints, with a further 3 axes in the wrist, giving 6 degree of freedom. Its end effector can be manipulated to any orientation in the work envelope, which is almost spherical. The capacity to reach over and around constructions and twist or tilt the end effector, make it ideal for complex part removal/installation, processing, arc and spot welding, paint spraying, mould unloading and machine tending tasks.



Picture 1 - Robot manipulator

Flexible Robotic Workcells

In factory automation and elsewhere it was once common to use fixed layouts built around conveyors or other transportation systems in which each robot performed a specific task. These assembly lines had distinct workstations, each performing a dedicated function.

Robots have been used at the workstation level to perform operations such as assembly, drilling, surface finishing, welding, palletizing, and so on. In the assembly line, parts are routed sequentially to the workstations by the transport system. Such systems are very expensive to install, require a cadre of engineering experts to design and program, and are extremely difficult to modify or reprogram as needs change. In today's high-mix low-volume (HMLV) manufacturing scenario, these characteristics tolled the death knell for such rigid antiquated designs.

In the assembly line, the robot is restricted by placing it into a rigid sequential system. Robots are versatile machines with many capabilities, and their potential can be significantly increased by using them as a basis for flexible robotic workcells

The rising popularity of robotic workcells has taken emphasis away from hardware design and placed new emphasis on innovative software techniques and architectures that include planning, coordination, and control (PC&C) functions. A great deal of research into robot controllers has been required to give robots the flexibility, precision, and functionality needed in modern flexible workcells.

Robots are highly reliable, dependable and technologically advanced factory equipment. The majority of the world's robots are supplied by established companies using reliable off-the-shelf component technologies. All commercial industrial robots have two physically separate basic elements—the manipulator arm and the controller. The basic architecture of most commercial robots is fundamentally the same, and consists of digital servo controlled electrical motor drives on serial-link kinematic machines, usually with no more than six axes (degrees of freedom). All are supplied with a proprietary controller. Virtually all robot applications require significant design and implementation effort by engineers and technicians. What makes each robot unique is how the components are put together to achieve performance that yields a competitive product. The most important considerations in the application of an industrial robot center on two issues: manipulation and integration.

The combined effects of kinematic structure, axis drive mechanism design, and real-time motion control determine the major manipulation performance characteristics: reach and dexterity, pay load, quickness, and precision. Caution must be used when making decisions and comparisons based on manufacturers' published performance specifications because the methods for measuring and reporting them are not standardized across the industry. Usually motion testing, simulations, or other analysis techniques are used to verify performance for each application.

All common commercial industrial robots are serial-link manipulators, usually with no more than six kinematically coupled axes of motion. By convention, the axes of motion are numbered in sequence as they are encountered from the base on out to the wrist. The first three axes account for the spatial positioning motion of the robot; their configuration determines the shape of the space through which the robot can be positioned. Any subsequent axes in the kinematic chain generally provide rotational motions to orient the end of the robot arm and are referred to as wrist axes. In a robotic wrist, three axes usually intersect to generate true independent positioning in terms of 3-D orientation.

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UDC 69.007

EVERYTHING YOU NEED TO KNOW TO BECOME A SUCCESSFUL CIVIL ENGINEER

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Nowadays the role of construction is very important. The need for buildings and construction will exist as long as the humanity exists, because the houses are vital for people. Moreover, the human culture includes various epic and monumental buildings which have become the genuine monuments. Many people participated in the construction of those buildings. Among them there were representatives of the profession which we now call "the civil engineer." Actually, construction engineers are demanded enough on the labor market. Despite the fact that worldwide universities graduate a large number of specialists in this field many companies need specialized (experienced) engineers.

Average salary of a civil engineer: [1]

Russia 20000-150000 RUB [2]

USA 4000-6500 $ ≈ 272000-442000 RUB (1$=68 RUB)

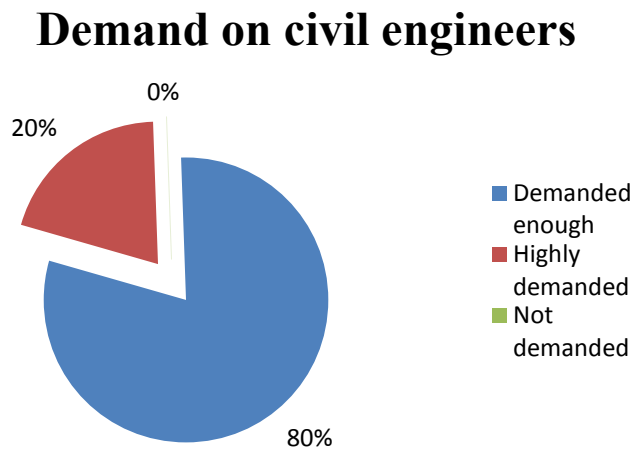

Fig.1

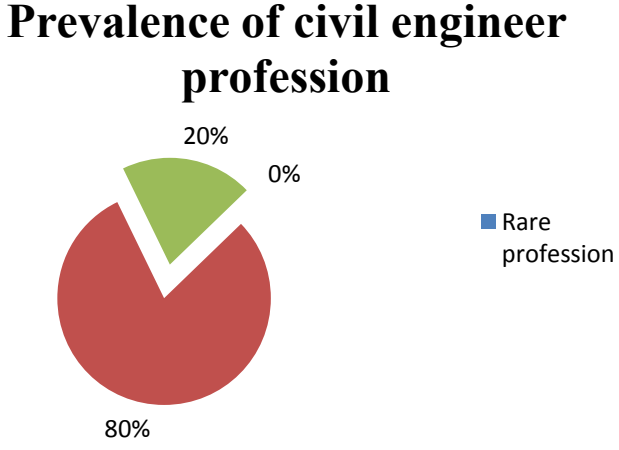

Fig.2

The profession of construction engineer consists of various specialization fields:

1. Mining and Drilling
2. Residential Construction
3. Commercial Construction
4. Urban Planning
5. Water and Gas Infrastructure
6. Sewerage Systems
7. Renewable Energy
8. Transportation Agencies
9. Government Agencies

And even more! If you're going to become a genuine civil engineer, you may decide one or several specialization fields. The more fields you've known and experienced the more demanded worker you will be. You may work as a consultant, contractor, a manager or someone else; often you'll have to be both a contractor and a consultant or both a manager and a consultant, or other. By executing two or more functions you take experience and knowledge; moreover, you become more demanded and you're paid a bigger salary; by varying your career you are always interested by new possibilities and perspectives so it's easier to find a work most suitable for you. But you should remember – every work requires your care, accuracy and efficiency. [6]

To make success after graduation and take a job related to the specialization, the future civil engineer should have some abilities and skills:

✓ Skills, experience and knowledge of specialized area(s)

Of course, you have to orientate yourself when you solve some problem or do the work related to the construction. This experience should include your knowledge of disciplines you've studied at school and university (many firms prefer specialists who have finished the university and have taken B.S. or (more desirable) M.S. degree).

✓ Maths, Science, Design and Computer skills

Some of these skills you've known from school, some you've learnt at university, and some of them you've explored by yourself, as a self-development. They are needed in learning special knowledges necessary for your profession and calculating, accounting and reporting.

✓ Independence

While searching for new worker, a company prefers to choose independent worker who is not confined in actions, for example, by pregnancy or disability to move or do something. Sometimes sick or old members of family act as a restrictive factor for engineer's efficiency.

✓ Responsibility, attentiveness and accuracy

All this abilities help the engineer to do his work clear and to get success.

✓ Creativity

It's the most important ability if you want to solve problems without problems by founding the most effective and easy decision

✓ Communication and teamwork skills

These skills will help you to act with a team and to work more efficiently.

✓ Project management skills and decision making

You need to be able to rule the project, distribute the work between the team and control the execution depending on the time and the budget. You should fell the aim of the project for most favorable result.

✓ Ability to work under pressure with the orientation on results

There are times when you will have to work out of hours because of some problem suddenly appeared. You should be ready for it. On the other hand, the overtime work may

give positive results and you may be paid for spent time or be advanced.

✓ Readiness to participate in development of the company

Every company should develop, otherwise the depression in work and management will be the reason of bankruptcy and loss of job.

✓ Readiness to change and develop yourself

Finally, you should be ready to develop yourself, because a job can require something greater than you can know or do. Try to accept them adequately and change yourself depending on these requirements. [5]

If you feel you have these skills, then you have what it takes to train to be a civil engineer.

Concerning the education, you should focus on the following disciplines:

✓ Maths
✓ Physics
✓ Geology (general knowledge)
✓ Theoretical and construction mechanics and strength of materials
✓ Descriptive geometry and drawing
✓ Technology of construction
✓ Methods of design, construction and quality control of buildings
✓ Basics of making tender documents (includes knowledge of codes and regulatory standards). [5]

You can participate in some competitions, conferences or Undergraduate Exchange Program to increase your experience and knowledge of your profession or to train your performance, verbal and communication skills. It can be helpful when you will work in a team. Besides, the Exchange Program can help you to see what's going on in the construction industry in other countries and what's the level of education and development of construction. Maybe it would be better for you to work in other country? Some refresher courses can also be useful. [4]

And the last – you should be confident in your aims and not look back hesitating if you did something wrong and because of it someone, for example, failed when employing some job, because you did it. You should be sure you are more suitable for this job than someone else; you have appropriate skills, knowledge, and experience, and your admission (to the job) is deserved. There's no need to feel sorry for him.

Table 1. The job of civil engineers in Russia and USA: similarities and differences of desired skills [3,7]

Desired skills and Experience	**Russia**	**USA**
B.S. degree in related engineering field	required	required
M.S. degree in related engineering field	required	preferred
Minimum work experience + experience in design and planning projects	3-5 and more	2-10 and more
Strong project management skills	+	+
Successful marketing, proposal writing and management	+	+ Plus public presentations experience
Strong written and verbal communication skills with demonstrated ability to conduct effective presentations and written report preparation	+	+
Previous supervisory + mentoring experience	+	+
Registration in American/Russian state/city	-	+
"Self-starter", result-orientated and be able to work under tight deadlines	+	+

Skill in operating various specialized software and office equipment, e.g. large format plotters, Auto-CAD-Civil3D, WaterCAD, Hydra-Flow, MS Office/Excel, HEC-HMS	+	+
Knowledge of current codes and regulatory standards	+	+
Ability to read and understand construction schedules	+	+
Having a valid Driver's license and a clean driving record	+	+
Willing to travel locally to multiple projects when necessary	+	+
Responsibility	+	+
Having a car	+	- (rarely; employers either have a regular driver or suppose almost every American has got a car)

Table 2. *The job of civil engineers in Russia and USA: similarities and differences of expectations [7]*

Expectations	**Russia**	**USA**
Experience managing and executing involving utility infrastructure	+	+
Consulting experience to manage and execute work on projects and to help ensure successful client relationships	+	+
Lead project team in planning and/or designing a major engineering project and coordinate special planning, economic, and engineering studies	+	+
Prepare and make presentations to clients for professional meetings	-	+
Successfully manage and deliver projects on time and on budget	+	+
Participate in improving company resources and tools to improve design production and efficiency	sometimes	+
Direct the work of drafters and designers, coordinate with other disciplines	+	+
Supervise, delegate and oversee the work of technical staff and engineers (developing the scopes of work, project hours, and project schedules)	+	+
Assist with business development pursuits	sometimes	+
Have technical responsibility for interpreting, organizing, executing, and coordinating assignments	+	+
Tendering for construction documents, and the installation of engineering equipment	+	+

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7 WONDERS OF ANTONI GAUDI

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Antoni Gaudi…Have you ever heard this name? Who was he? He was a great Catalan architect, a trendsetter, the man almost never worked with the drawings, the specialist based on a rigorous mathematical calculation. Gaudi used the outline of the building in the impressionist style. His main instruments were imagination, intuition and calculation in mind. You could say he was Einstein in architecture (or vice versa – Einstein was Gaudi in theoretical physics: Antoni Gaudi was much older).

Gaudi was extremely uncommunicative and even closed. He was rude and even cruel with his employees. He was the ascetic who didn't receive luxury when it came to him personally. But at the same time Antoni Gaudi built luxurious buildings known around the world. Sargada Familia is the most important Gaudi`s work. He invested all the earned money in the construction itself. For many years he worked for free thinking he had no right to use people`s money; the temple Sargada Familia was built due to Barcelona citizens` donations. The architect didn't leave any record after himself, he hadn't friends. Many facts of his life had still not cleared up…But what Catalans say about Gaudi? Ask anyone – they idolized him.

Gaudi said: "human is always in a creative process. But people doesn`t create, they discover. Anyone who wants to understand the nature laws to justify his job works in conjunction with Creator. Those who only copy don`t help him. Therefore originality is in returning to primary source." This is the greatest Gaudi`s paradox. The further he moves away from the idealism of youth, the stricter his Catholicism, the deeper his anti-liberalism and pessimism, the greater his suffering - the more beautiful his architecture.

Sagrada Familia (1882-our days)

It is the most famous long-term construction in Spain - the temple is built for 130 years! It is planned to finish the construction of the temple in 2026! Gaudi planned many internal parts. The desire to avoid straight lines, along with the desire to simplify the design, led to a decision to use principle of using the geometric shapes with a ruled surface, such as a hyperboloid, hyperbolic paraboloid, ellipsoid and the helix. These surfaces can be obtained by direct movement, and therefore their intersection is a straight line, which greatly facilitates the articulation of various design details.

The main element in the structure of the church is the columns. Depending on the load columns vary in thickness and height. With a height cross-sectional shape of the column is gradually turn from a star into a circle. As we approach the arches, columns branch out, creating an unusual design in the form of forest. This unusual architectural solution was initially dictated by structural necessity: the search for the center of gravity rests on the column of the vault.

Casa Vicens (1883-1885)

This house was the first Gaudi`s self-built. Casa Vicens is a motley mix of different architectural styles. The house designed for summer residence was commissioned by Manuel Vicens, a manufacturer of bricks and tiles. It was built of raw stones, bricks and colored tiles arranged in a checkerboard pattern with floral ornaments.

Gaudi used a large number of different decorative elements such as turrets, bay windows, balconies. This enabled him, despite the simplicity of the shape of the building, to achieve a surprisingly volume rich solutions.

Even today from Casa Vicens wedged in a narrow street Carolinas - with its green and creamy-yellow tiles, always lowered blinds and tightly locked Iron Gate - blowing fantasy atmosphere. For the first time examining the place of future construction, Gaudi found giant blossoming palm tree surrounded by a carpet of yellow flowers; between its leaves in search of insects scurrying birds. Gaudi subsequently included in the design of the house all these motifs and a huge metal web has become an original canopy over the patio, effectively scattering the sun's rays.

In the garden Gaudi built a small observation post of brick - mirador, ruled the area this mini estate with two separate fountains. Its stages covered with parabolic arches invite visitors to enjoy a pleasant view and feel the cool waters of this peaceful oasis.

El Capriccio (1883-1885)

El Capriccio is a summer house on the Cantabrian coast in the town of Comillas, near the city of Santander, Spain. The quaint little palace built in "modern" style, belongs to the early period of Gaudi. Colored paints were chosen for the exterior finish of the building. Cap is issued by rustic stone yellow-gray; facade is laid by strips of colored bricks, alternating with bright majolica tiles. Relief majolica portrayed graceful flowers and leaves of sunflower.

The project of the famous cottage called El Capriccio (Spanish for "whim") was created by Antoni Gaudi. El Capriccio plan repeated Casa Vicens plan. Thus, a utility room and a kitchen were located in the basement, a living room and a bedroom were on the first floor, and the official appointment of the room was in the attic. Despite the fact that both buildings were similar in interior arrangement, El Capriccio structure was more complicated than Casa Vicens composition. The complexity of the structure was the following: the architect tried to connect in three levels radically different floor plans. In this case the master combined them in the vertical direction by two shafts of spiral staircases.

Palau Guell (1885 - 1890)

Palau Guell is the urban apartment house in Barcelona, built by order of the Catalan industrialist Eusebi Guell. Antoni Gaudi joined the traditional rectangular structure and coffered ceilings with innovations such as a parabolic arch. Palace has four main floors, a basement (ground floor) and a flat roof terrace.

The central part of the palace with the three-storied music room and the chapel reflected Gaudi`s desire to control the space. The palace was a great innovative incarnation of the Venetian "palazzo" hopelessly wedged in the narrow space. With considering of the limited size of the facade Gaudi`s aspirations were aimed at understanding and implementation of open-plan home and forward up forms.

Park Guell (1900-1914)

A typical style of Gaudi is first appeared here. Design, theme, external decoration and functions were combined in a single unit. From that moment we can talk about Gaudi as one of the greatest sculptors of the twentieth century. Gaudi realized that he can create a new language of forms by returning to the Catalan tradition of the craft. Lining like fish scales created by several layers of thin ceramic tiles formed arches and vaults, strong and at the same time decorative.

Roads rising up were supported by columns that formed viaducts system. Park with its numerous winding paths reflected the Gaudi`s hate to the sterility of a straight line. Park Guell

is extremely theatrical. Its outer walls are decorated with ceramic plaques with the name "Park Guell" and the message of its isolation from the outside world.

He used different-heights landscape (resulting the streets in the park were in the form of viaducts) and new materials - such as gravel and ceramic waste - battered tile fragments, delivered to local factories.

Casa Batllo (1904 - 1906)

Casa Batllo, or House of Bones, was built in 1877. And it was reconstructed by Antonio Gaudi. The most remarkable feature of Casa Batllo is the almost complete absence in its design of straight lines. Wavy contours appear in decorative detail facade carved out of hewn stone and in the interior. All the decorative elements of the house are made by the best masters of applied arts.

The smallest details of designs and decorations were carefully considered in Casa Batllo. Gaudi has created a special play of light and shade: in order to achieve uniform illumination Gaudi gradually changed the color of ceramic tiles from white to blue and dark-blue, intensifying it as you move from bottom to top and ending with the present surge in blue decoration smoke and ventilation pipes. Resizing of windows serves the same purpose (they gradually decrease with height). Elegant and functional loft is organized with parabolic arches used by Gaudi in other projects.

Casa Mila (1906-1910)

The design of this building was the groundbreaking for its time: an elaborate system of natural ventilation eliminates the air-conditioning. You can move on your own interior walls in each of the apartments of the house. And there is an underground garage. The three courtyards (one round and two elliptical) are the characteristic design elements. The architect constantly used them fill the spaces in their buildings a sufficient amount of light and fresh air.

Facades in patio are covered with polychrome, mostly with floral motifs. Floral decorations and frescoes inspired by the mythological motifs also adorn the ceilings and walls of two entrance vestibule and main staircase. The wavy roof follows the rhythm of the main facade, with alternation of different elements: stair exits, ventilation and chimneys. Most of them are lined with mosaics of fragments of bat pottery, pebbles, marble and glass.

Casa Mila is especially beautiful at night when the lights turned on its facade.

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УДК 620.91

UNUSUAL SOURCES OF ENERGY

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People keep on trying to find new and cheap sources of energy. It would be better if they were "underfoot" and their production could be organized without any efforts right at home. Some unexpected and sometimes quite weird energy sources have already been found.

Super yeast

Genetically modified yeast was found to be able to digest coarse fibrous xylose in plants. This is the part of plants that always goes to waste creating the perfect toxic environment for microbes. However, improved yeast could actually split in chemical components "cooking" biofuel.

The turnstiles in public transport

The Japanese company East Japan Railway Company has decided to equip each turnstile with a generator of electricity. So the passengers passing through them, without realizing, will produce electricity.

Energy from the volcano [pic.1]

Within the bounds of the competition “e-Volo” in 2013, a group of Chinese architects presented the project of a skyscraper “Volcano Electric Mask”, which should be located on the slope of a volcano. Energy for the building operation will be obtained from molten magma, approached the Earth's surface.

Pic.1 - Skyscraper “Volcano Electric Mask”

Soccket’s soccer ball

The Company Soccket Inc. created a soccer ball which is, the same time, a small power plant generating energy during the moments when the players hit the ball with their

feet. After a few hours of playing the work of a light-emitting diode lamp is ensured for the whole evening!

Playground “Green Heart” turning burnt calories into electricity

Many sceptics laugh at the sportsman, claiming that their energy spent on exercises could be used for generating electricity. The creators of Playground “Green Heart” followed this opinion and for the first time made the set of street gym apparatus, each is a small power plant. The first Playground appeared in November 2014 in London. The electricity that is produced thanks to the lovers of physical exercises, can be used for charging mobile devices: smartphones or tablet computers. The playground sometimes sends its excess energy to the local network.

“Giraffe Street Lamp” – power station hidden in children’s swing [pic.2]

It is paradoxical that even children can be brought to produce "green" energy. Because they are never against to do something like playing and entertaining themselves. Therefore Dutch engineers created an unusual swing called “Giraffe Street Lamp”, which uses the children's restlessness for generating electricity.
The swing produces energy during being used for its intended purpose. Rocking themselves to and fro, children or adults stimulate the dynamo built into the swing.
Of course, the received electricity is not enough for the sterling operation of a private dwelling house. But accumulated energy for a day is enough for a street lamp for about two hours after twilight.

Pic.2 - Power station hidden in children’s swing

The warmth of the human body

Few people think that any human being could actually give energy him or herself. However, the man’s heat can be used, for example, for recharging electronic devices. So, in February 2016 you could buy a portable torch, which is able to take energy from its owner. This project of an American engineer, Ross Zhuravskiy, attracts a great interest among the followers of "green" energy, so the necessary funds for mass production of such torches have been gathered just in a day.

The human warmth can do even more. For example, a Swedish company “Jernhuset” uses the visitors’ heat at the Central station in Stockholm for heating the station itself. Here

there are about 250 thousand people a day. And all of them, regardless of what they do, produce energy. Due to heat exchangers in the ventilation system of the station the heat is converted to hot water, then it is pumped into the heating system of the neighboring building. The system is not only environmental friendly but also profitable. The cost of heating the station has been cut down by a quarter.

In France at the underground station the warmth of passengers' bodies has been started to use for heating a building located above the station. Is it fiction? No, this is reality! The agency Paris Habitat, the largest owner of social housing in Paris, reports that 17 apartments are heated in this way.

Such "zero" or "passive" heating of buildings where heat sources are people and working appliances, are already working in other countries, they heat shopping centers, office buildings and houses.

But the inventors go further, believing that the dead can also contribute to energy efficiency. In Sweden, the crematoria have actively been involved for heating cities. The ovens of the crematoria are connected to the Central heating system. The staff says that the locals do not show serious concern about it. The main thing is the warmth in their houses.

The energy of nappies

On average, it is necessary to have 10 or 14 nappies for a newborn baby every day. In Japan there is great demand for adult nappies, and this market is growing. Usually any disposable nappy is just sent to the dump, which is quickly overflowed. But everything will change soon.

The Japanese company Super Faiths Inc. has developed a way to turn nappies into energy. According to the company website, firstly the nappies will be chopped, fragmented, dried and deodorized. After this process they will be granulated, and 1 kg of granules will be to allocate about 5 thousand kcal of heat. The granules are intended for the use in heating and producing electricity by means of biomass.

This method is quite attractive, because only the Americans throw away about 18 billion diapers a year. The only problem is that the Japanese use paper nappies, whereas in other countries they contain a lot more plastic and may not be such good sources of energy.

The energy of alcohol

Since 2007, at the Swedish border all confiscated alcohol is transported 200 km away to the plant in the city of Lincheping, where it is heated and turned into gas. The hundreds of litres of contraband alcohol are used for fuel production for buses, trucks and even trains.

The officials claim that "a quart of pure alcohol is enough to make one-tenth of a gallon of gas", a large part of the raw material is given to the plant absolutely for nothing.

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УДК 621.311=111

THERMONUCLEAR FUSION AS SOURS ENERGY SUPPLY

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The life of modern man can't be imagined without constant consumption of electric power. It is well known, that power plant produces electric power using fuel. Resources of this fuel are limited and constantly depleted (oil, gas, coal). Also the production of working power plants is very harmful to the environment.

Since the middle of lastcentury nuclear physicists have been developing a new method for production energy controlled thermonuclear fusion.

What are the advantages?

Firstly, nuclear reaction can use small amount of fuelfor getting great energy. Resources of fuel are practically inexhaustible; they can beextracted on the coast of any ocean.

Secondly, it is the most eco-friendly process of getting power. Coal power plant harms human health even during normal operation much more than accidentalexplosion of nuclear power plant. Unlike fission reaction, fusion reaction requires tiny amount of dangerous isotope andfusion products are non-radioactive and non-toxic, they are hydrogen and helium.In addition, to minimize transportation danger, it is planned to produce radioactive isotope directly on nuclear power plant.

What is fusion?

Nuclear fusion is an association of small cores into one larger core with the release of energy. Most easily realizable reaction is reaction of interaction deuterium and tritium. As the result of its reaction one atom helium and one neutron is formed. This reaction gets significant energy output, 17.6MeV.

$$ {}_{1}^{2}H + {}_{1}^{3}H \rightarrow {}_{2}^{4}He + {}_{1}^{0}n + 17{,}6MeV $$

How can the reaction of thermonuclear fusion be realized?

To become energetically profitable the thermonuclear reactionmust provide sufficiently high temperature of thermonuclear fuel, its density and low energy losses. Lawson criterion is responsible for gettingenergetically profitable reaction. It determines the minimum frequency of synthesis reactions per second whichis necessary for reaction sustenancein a material environment. Lawson criterion meaning is that when the reaction of the starting temperature is reached, it needs compromise between ion density(particles concentration) and confinement time

$$ Nt > about 10^{20} $$

The firstdevice which helped to get controlled thermonuclear fusion is Z-pinch. The principle of operationis simple: electricalcurrentgeneratesmagnetic field whichinteracts with this currentand pinches this current. As the result, plasma's density and temperaturethrough which the current flowsincreases. Butenergy losses remain large because plasma contacts with electrodes and gives its heat.

The greatperspective of thermonuclear fusion is connected with the tokamaks now. Tokamak (toroidal camera with magnetic coils) is toroidal installation which provides magnetic plasma confinement underthe conditions which are necessary for thermonuclear

fusion implementation. Tokamak is folded in ring Z-pinch and it isthe sequence of mirror machinewhichcreates «corrugated» magnetic field. Mirror machine is trumpetwith longitudinal magnetic field which is stronger at the ends of the trumpet and it becomes weaker at the center. The strong field at the ends createsmagnetic «mirror» which confines plasma in the installation.

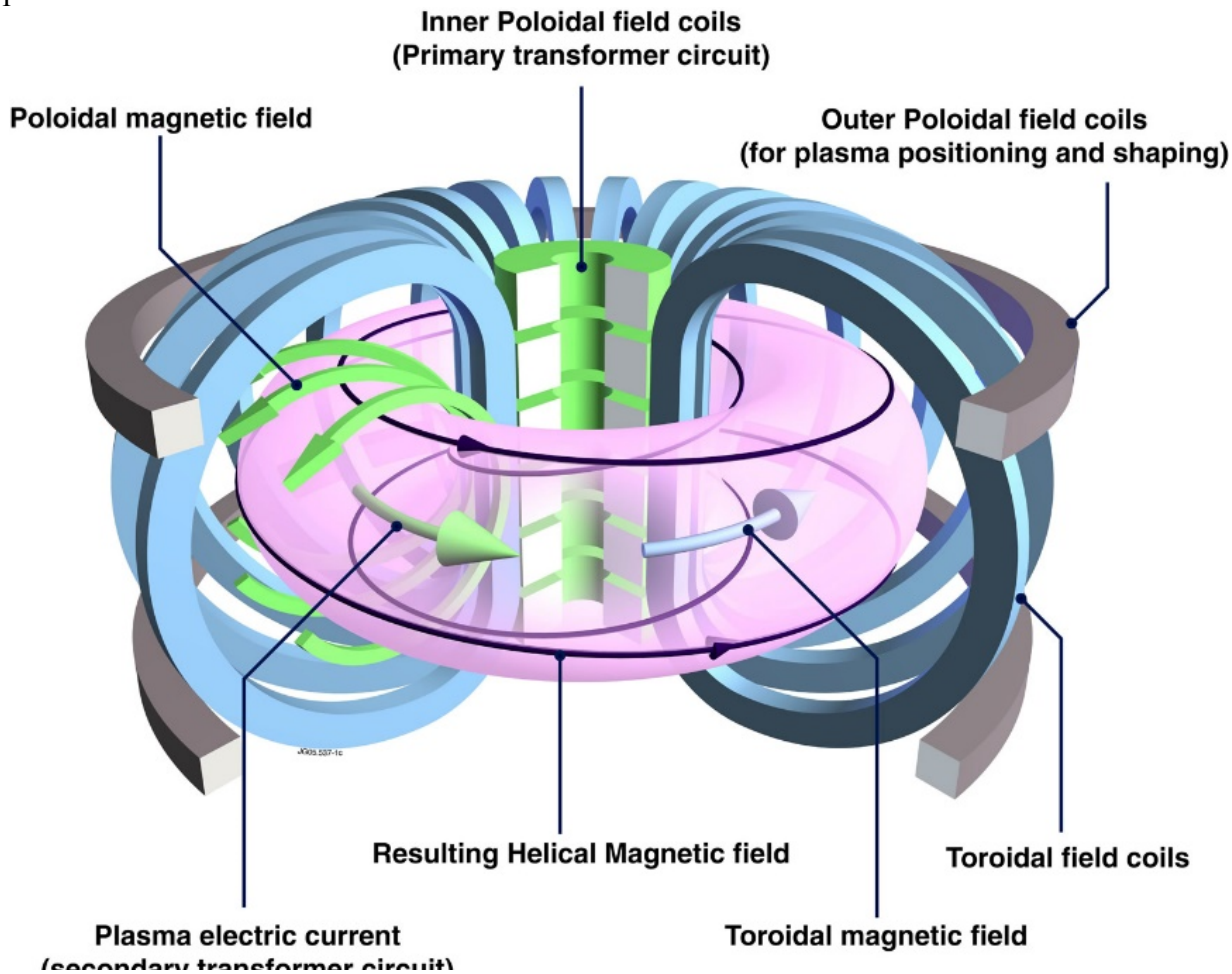

Fig.1 - Tokamak's structure of inside

What problems arise in the implementation of the controlled fusion reaction?

Now experimental thermonuclear reactor ITER is building in France. Its task is to show capabilities of commercial using of thermonuclear fusion and decision of physical and technological problems which can appear in course of this work. But ITER costs billions dollars. This is unacceptable for commercial reactors.

No one reactor can work for hours nowwithout supplying sources.

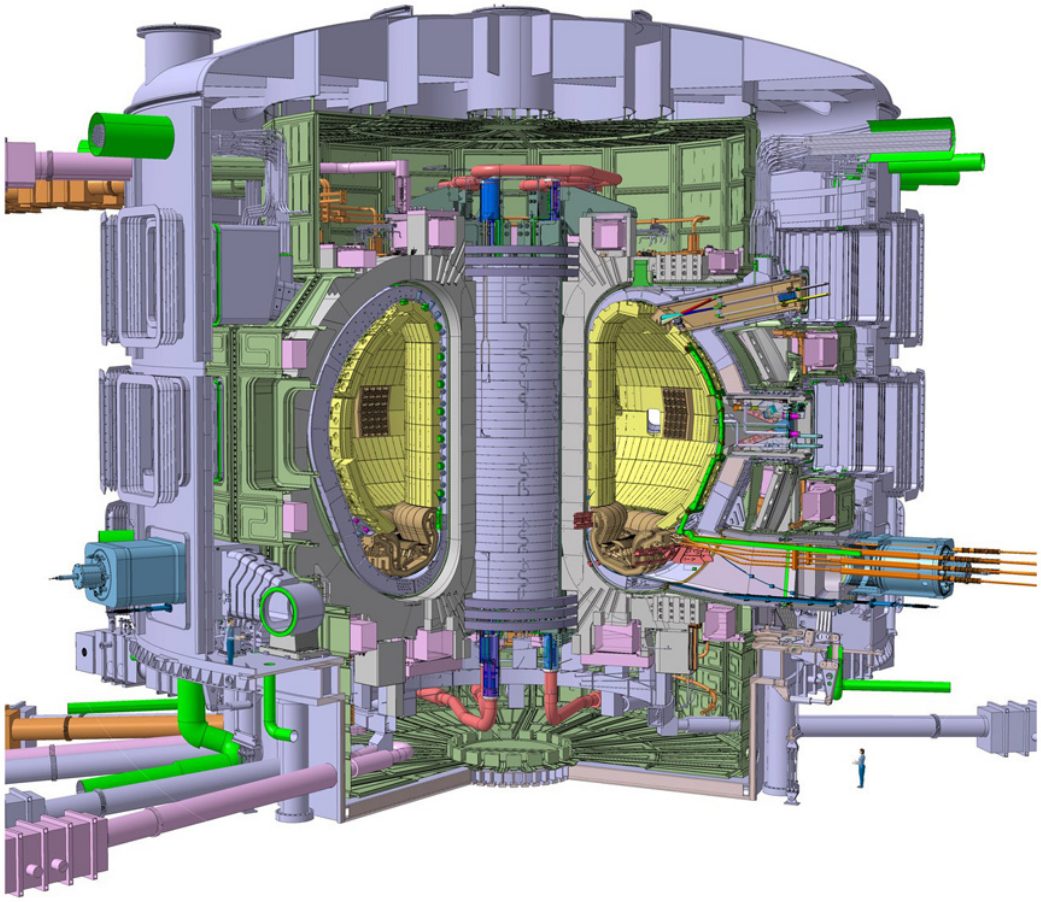

Fig.2-ITER circuit

What is the future of fusion?

The task has been realizedin investigation of thermonuclear fusion and decision problems related to its significance.The perspectivesfor mankind are promising. Scientists predict commercial using of thermonuclear fusion the next fifty years. So we can say with the confidencethat in future thermonuclear fusionwillbe a major sours energy supply.

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УДК 644.48

GLOBAL WARMING: A MYTH OR A REAL THREAT?

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Each of us has heard about global warming, but not everyone understands what it is and where it comes from. Global warming is increase in the average temperature of the climate system of the Earth. The main reason for this is called the carbon dioxide emissions into the atmosphere. Humans emit CO_2 into the atmosphere. That leads to the CO_2 increase which, in turn, results in the greenhouse effect growth. Thus the more amount of warmth is concentrated around the earth.

Krasnoyarsk is the second largest after Norilsk (2008.9 tons) CO_2 emitter. In 2007, the city emissions accounted for 278,000 tons. Moreover, emissions of pollutants into the atmosphere of the Krasnoyarsk Region from stationary sources in the first semester of 2015 were 1.25 million tons. This is 13% more than in the same period in 2014, according to Krasnoyarsk statistic agency.

Warming causes glaciers melting, increases the amount of water in the ocean, droughts, trees dying out, which absorb CO_2, and the level of the gas increases again.

Now it is just global warming, but if it does not stop, then it may cause an ice age in the northern hemisphere. And it can happen because of the Gulf Stream, which delivers the warm air from the equator to the northern hemisphere. However, as the Arctic ice is melting and influences the Gulf Stream, the warm flow may disappear. Accordingly, without the Gulf Stream, the northern hemisphere will freeze.

Fig. 1 - Photo of Grinnell glacier in glacier National Park (Canada) in 1938 and 2005 Photographer: Mt. Gould

In the last million years the CO_2 amount in the atmosphere has increased a little, but in recent years the situation has dramatically changed. The temperature is very close to the critical point, and if it reaches it, the climate will not be controlled. Hurricanes, like Katrina, may become a norm.

Nowadays the global average temperature increase is only 0.7^0. However the temperature indicators have beat all the records for the last time. Perhaps a couple of extra degrees today do not mean anything, but it is only a few degrees that separate humans from the ice age, and probably from a catastrophe.

Fig. 2 - The impact of global warming on Sydney. 2-4^0 temperature increase

The main problem is that humans take nature for granted. After the 19th century industrial revolution the nature became a resource. The man is a part of nature and our life on the planet is possible only because some parameters, such as temperature and pressure, are within a strict range.

Now, about 25,000 species of animals disappear each year, amount of hurricanes has increased up to 15%, and the frozen soil of the tundra begins to melt. After several millennia, or possibly by the end of the century, in the Arctic there will be almost no ice. The UN suggests that by mid-century about 150 million climate refugees may appear. Moreover, two

decades ago, asthma was not a problem, but now, according to the indicators of the global health association, more than 440 million people suffer from this disease.

The warming process makes some animals move to the north. They explore new territories where previously they would not have survived. Regarding the north animals such as polar bears and penguins, they will have to change their habitat, because of its destruction. Also, many plant and animal species may disappear, unable to adapt to a rapidly changing climate.

Humans take too much from nature, without giving anything in return. More than 70 countries have already lost their forests. In the USA, almost 90% of the forests have been replaced by deserts. People do not realize how much plants, trees particularly, provide us. They can hold 50,000 liters of water, preventing soil erosion. Scientists estimate that recycling carbon dioxide into oxygen would have cost us 35 trillion dollars a year. But if to add up the income of all countries the total will make $18 trillion. Moreover plants give it to us for free.

The first global agreement on the environmental protection is known as the Kyoto Protocol. It was signed in 1997 and involved both developed and developing countries. The major purpose was to reduce or stabilize greenhouse gas emissions. The initiative really worked. Though it united quite few countries. The breakthrough was made by the Paris Agreement, adopted in December 2015, under which all countries of the world committed to a greater or lesser extent to reduce the CO_2 emissions in order to curb the rise of the global average temperature at the $1.5\text{-}2^0$. However the document will empowered only since 2020.

The situation is possible to change currently. There are several solutions. To start, you need to change people's mind, to leave the consumer attitude to nature, to live in agreement with it. It is necessary to replace the currently used fuels, use renewable energy like solar and wind. The waste-free production of the closed cycle should be adopted from nature where there is no waste, a dead body will be food for another. We have the opposite situation: 1 kg of the finished goods leaves 2 kilograms of garbage. Taxes for people using gasoline can be raised whereas they can be reduced for others. Another example from nature is to construct buildings able to provide themselves with needed energy. They may convert solar energy into light and heat, for instance. Also it would benefit the country economy, there will be a lot of jobs, because a big number of people will be involved in construction, development and servicing.

To summarize, the analysis of reasons has revealed that the global warming is mostly resulted from human industrial activity. The data currently registered and computer-simulated climate changes predict dramatic and disastrous outcome. Unfortunately global warming is far from being a myth. It is the threatening actuality humans have to take into account, work out methods to slow it down or to reduce.

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УДК 72

ECO ARCHITECTURE IN HUMAN LIFE

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The development of environmental design and architecture is becoming increasingly popular and necessary for each of human. No one denies that the relationship between physical and mental health and the environment is great.

The study of harmonious forms of wildlife provides material and helps to solve the problem of the harmony of functional and aesthetic principles. So today, scienceworkwith biology and technology that solves engineering problems based on the analysis of the structure and life of organisms. Bionics plays an important role in the design.

Particular stylistic direction

Bionics is considered to be a promising direction of modern design, which feeds flight of imagination of designers. Eco-design is a way to develop products based on the environmental impact of the product throughout its life cycle. Eco architecture will reduce consumption of fossil fuels while providing esthetically pleasing structures that will be good for the environment.
Green design is sometimes referred to as a bright green or sustainable design.

Eco-design takes into account:

- The amount of resources consumed by people such as water and energy.
- Reliability and quality of the manufactured product.
- Chemical emissions from production.
- Quantity volume and waste during production.
- Product design.
- Observation from the production start till reuse, recycling or biodegradation.

Eco design can be used almost anywhere. Starting from small product to be used in the design of buildings and cities.Urban planners use eco-design for urban planning that are safe for humans and produce waste minimization. The sustainability movement is making an impact in many areas of daily life, including eco architecture. From utilizing local food sources to reducing energy consumption across the board. Eco architecture seeks to minimize the negative environmental impacts through improved the use of sustainable construction materials.Designing green buildings in cities is one of the most important. Eco friendly house design takes into account the life cycle of building materials. Eco house of used alternative energy sources such as wind solar power and rain.Environmentally friendly home also applies to gardening. Construction of eco-homes with the use of the landscape. Eco-design is a vast field creativity for graphic design. Graphic design includes an elaborate and clean packaging. Eco-friendly documents, printed materials, and production methods that minimize the amount of waste.As the world has increasingly focused on sustainable initiatives, green architecture is a booming industry. Everything from single-family houses to huge complexes gets full green treatment, and innovation.Modern technologies allow achieving great results in eco-design. The modern world requires a new approach to construction. Eco-design projects come to life and work today.

Examples of existing projects

Rotating Tower, which has developed by architect David Fisher, proposed rotation plan of the tower, which produce his or her own energy from wind energy. "Rotating Tower" will rotate and create ever-changing silhouette in the sky.

Water is expensive and engineers are looking for ways to provide a continuous supply of fresh water to meet the needs. Charles Patton addresses this problem and proposes a project "Seawater Greenhouse". This building is a performing arts center in the Canary Islands of Spain. It works through a combination of evaporators and condensers, so that the moisture in the air and then collected from the evaporator condensers, which cooled by deep seawater. "The center will be run entirely on renewable energy sources.

Thus, the urban environment of a large city should be different from each other environmentally sound creditworthiness, cultural and ecological thinking and natural language expressions. Eco-design makes a harmonious environment; He supports environmental values, reflecting their clear language of artistic forms.

Eco design fit snugly into our lives. Eco-design becomes fashionable environment. The environmental problems of the planet is a very popular topic of discussion. Eco-design is solution to many problems. The problems of sustainable development are challenging designers, manufacturers and consumers alike to consider ecological values and operating methods.

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УДК 620.98

THERMONUCLEAR POWER PLANT AS THE GENERATOR OF POWER AND HEAT

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A lot of words have been said about the alternative and renewable energy sources. The future of energy consists of solar panels, wind turbines, geothermal power plants, especially according to shortage of our planet's resources.

However, a solar power station capacity can't compete with a capacity of the average, or even a small hydroelectric power station, and every power plant of such kind depends on the geographic location and climatic and weather conditions.

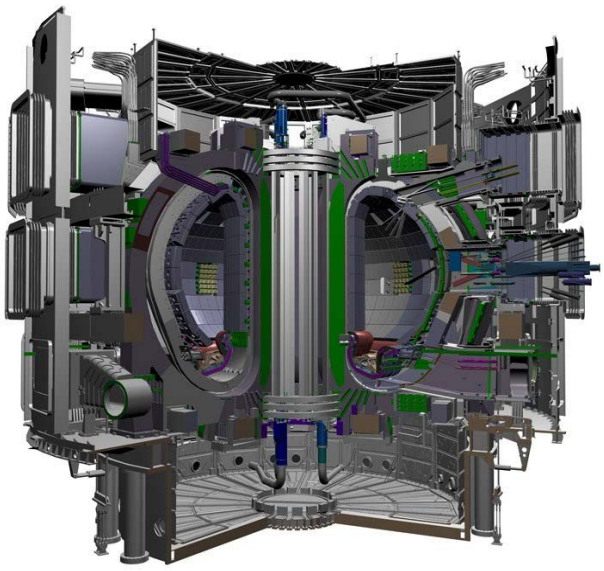
The climate is quite harsh in our country, and minerals are mined in abundance, so the emphasis is on traditional energy. But, for example, hydrocarbons stock remains only for 30 years of production, according to experts. The term is not very big, despite the fact that this is one of the most significant resource potentials in the world, and if we take into account the current economic situation, the decline of oil prices and increasing extraction rates, the issue of alternative sources is increasingly acute.

The nuclear and thermonuclear energy solve many tasks in the sphere of energy supply. Let's consider this topic.

First of all, you should understand the differences between nuclear and thermonuclear reactions. The basis of a nuclear reaction is ^{235}U fission, so that energy is released[3].

The thermonuclear reaction is reverse reaction of synthesis of new particles from existing, accompanied by huge release of energy, and much more than in the fission reaction in the fuel ratio.

The principle of a fusion reactor is that we direct the current inside the reactor chamber, heat the plasma using microwaves and hold it in this state, so that the fusion reaction occurs (pic. 1)[1].



Pic.1 - "Tokamak" (toroidal chamber with magnetic coils).

There are some reactions[2][4]:

1) $^{2}D+^{3}T \rightarrow {}^{4}He$ (3.5 MeV) + n (14.1 MeV)
2) $^{2}D+^{2}D \rightarrow {}^{3}T$ (1.01 MeV) + p (3.02 MeV) 50%
$^{2}D+^{2}D \rightarrow {}^{3}He$ (0.82 MeV) + n (2.45 MeV) 50%
3) $^{2}D+^{3}He \rightarrow {}^{4}He$ (3.6 MeV) + p (14.7 MeV)
4) $p+^{11}B \rightarrow 3{}^{4}He$ + 8.7 MeV

The first one and the second are radioactive, but the third and the fourth let us suppose, that thermonuclear power plant can be used as thermal power plant to produce heat for central heating systems. We can't make this on nuclear power plants, because there is a risk of water pollution with radiation.

How does it work? In ordinary thermal power plant we use hot steam to revolve the turbine to produce electricity (generator). This steam also goes through the pipeline to heating system of your house. Nowadays, the scientists are going to use thermonuclear reactor only in power generation mode. But it's enough to hold the pipeline with steam and water near the reactor, and we will get safe high temperature steam and water for heating!

It can be a profitable way to produce energy, but it is still under development, as far as the reactor begins to produce energy, it is necessary to run it and control the process, and that is the most difficult things. So there are the following issues:

1. Plasma instability. Its temperature is higher than the core temperature of the sun, and therefore there are no materials which would not evaporate upon contact with it. The superconducting magnets are used to control the reaction, but the current can become thinner or thicker somewhere, up to the rupture of the plasma ring (the current disappear), or the touching the walls of the reactor.
2. One component, tritium is expensive and we need a lot of isotope of this kind to produce energy. In addition, it is radioactive.
3. Powerful neutron radiation. A byproducts of the reaction are neutrons, which affect the reactor, and it wears out. As for the generated power, the neutron flux is in 5-10 times greater than that in conventional nuclear reactors. Moreover, neutrons have a much higher energy. This means the reactor construction made from the same material will be in operation 5 years instead of 50 (as in conventional reactors).
4. The plasma with a huge temperature loses a lot of energy by emission, and the camera has to be large to ensure stability, so that the minimum reactor power gets more hundreds of megawatts. This is not a disadvantage at all, because the network of these nuclear reactors can provide cheap energy for the whole world, but it's impossible to build a miniature reactor, and energy delivery in remote areas is sometimes even more difficult than getting it.

But still there are more advantages of fusion energy, than disadvantages. ITER is much safer than nuclear reactor. The chance for the Chernobyl catastrophe to happen again is equal to zero. The accident will be like an explosion on an ordinary factory, emission and radiation free. Furthermore, 1 kg of thermonuclear fuel is enough to receive energy obtained by burning of 10,000 tones of fossil fuels, such as gas and coal. The costs of launching and monitoring of the reactor for today is greater than the received energy, but recent projects of 2020 can produce 10 times more energy than it was used at startup. As a result of successful realization of fusion concepts, 1 km^3 of sea water (containing deuterium and tritium) will be enough to compensate all the available energy reserves.

And it's the best solution for the scenario of resource crisis. Let's hope that tests on projects such as the ITER, will end successfully. However, there are many problems to solve that require inquiring minds. It is needed at least 500 people for safe maintenance of the fusion reactor. So anyone who is interested can find a place in this exciting mechanism, that creates the future.

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УДК62-97/98

RADAR FEATURES AND ITS IMPACT ON HUMANS

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Radar is anelectronic device that can be used to detect objects at a distance. Army uses radars every day, but they are also widely used in civil life.So, humans have to coexist with radars daily.There arises a question regarding the effect they have on humans.

The aim of the work is to identify the of radar safety degree for humans.The following points were analyzed: radar functions, features and operation principle. Also electromagnetic radiation data of various radar typeswere compared and their impact on human health was revealed.

Firstly, radar functions and its operation principle were considered.

Radar features:

1. To detect the presence of an object in the distance.
2. Determine the speed of the object.
3. Create a map - orbiting satellites using Synthetic Aperture Radar technology to create detailed topographic maps of the Earth's surface.

All these functions can be implemented with two physical effects: the echo and Doppler shift.

Echo is an acoustic effect that you feel almost constantly. If you shout into a well, the echo comes back some time later. In a deep well, the time delay will be more between your cry and returning echo. Echo appears because some of the sound waves from your shout reflect off the surface of the water at the bottom of the well and come back to your ears. If you will detect the time after which the echo came back, and if you know the speed of sound, you can calculate the depth of the well is quite accurate.The Doppler shift is also widely spoken. You probably feel it daily (often without realizing it). The Doppler shift occurs when sound is generated by a moving subject or reflected from it. The Doppler shift can create sonic booms.Here's how to explain the Doppler shift. Assume that the car moves toward you with a uniform speed of 60 kilometers per hour, it starts to beep at a distance of one kilometer, and zoom in for exactly one minute. You will hear the start signal with a three-second delay.

Audio echo can be used to determine the distance to the object. The Doppler shift of the echo can be used to determine how fast an object is moving. Therefore, it is possible to create a «sound radar». Such radar is called «Sonar » and it is used by submarines, as well as anti-submarine ships to search submarines. We could use the same principles of sound in air, but sound in air has several problems:

1. The sound in the air does not extend very far from a half to two kilometers.
2. Only a deaf person can’t hear the sound, so the sound of radar would disturb people necessarily. However, you can resolve this problem through the use of ultrasound.
3. The sound echo can be very weak, so it will be difficult to detect.

Therefore, the radar uses radio waves instead of sound. Radio waves travel far, they are invisible and inaudible for humans, and they are easily detected even if they are weakened.

Let's look at a typical radar for detecting an aircraft in flight. Radar has a transmitter that sends a short, high-intensity, high-frequency radio wave packet. Transfer package may last a millisecond. Thereafter radar disables its transmitter, it turns on the receiver and listens to the echo. Then return time of echo and its Doppler shift are measured. Radio waves travel at the speed of light, so if the radar has a high-precision clock, it can measure the distance to the aircraft very accurately. With the help of special equipment for signal processing, radar

can also measure the Doppler shift and it can determine very precisely the speed of the aircraft.

Ground-based radars have more potential interference. When the inspector emits a radar pulse, it is reflected from all kinds of objects - fences, buildings, trees. The easiest way to remove this type of interference is determining that they haven't got Doppler shift. The radar is designed only to determine the Doppler shift, so the radar beam focus gets only one car.

Influence on human life.

1. Powerful stationary radars (air-defenses) with phased multi-frequency antenna. Their exclusion zone is a few km in the primary sector, the radiation on the minimum side lobes. The main beam doesn't touch the ground usually. It is necessary because enemy equipment can find the radar. The beam height is at least15 meters above the ground and 10-15º above the horizon. The width of the beam in the target tracking mode (so-called needle beam) is arc-seconds, in the review mode – arc-minutes. These stations have not brought any harm to anyone (although the beam is so powerful that it is able to cut down the shielded BREA (so-called on-board radio-electronic equipment missile). The supposed multiple reflections are far from being possible. The beam is always so targeted that it provides the maximum energy exactly to the sector of observation. If reflections admitted, they would interfere the radar itself.

2. Stationary air defense radar and airfield services and radar patrols. Operating frequencies - decimeters and centimeters (for different types). Especially dangerous old radars and radar's patrol 1960-1980's, they were designed, based on the large exclusion zone. Less power, but the width of the diagram unites minutes and degrees, and the sidelobe level is high enough.If the beam is directed to the window of the house that will bring a lot of problems to radar's patrol.

3. Wireless compass and altimeter airfields. Wireless compass has got circular field of view, and chart narrow (to catch the aim landmark). Altimeter airfields look into the sector take-off and landing, and his diagram as a horizontal fan that "waves" from the ground up and back (to detect target altitude). Sidelobe levels in both low. Outside working area do not threaten anyone, although the RWM-item can have an impressive view (especially with ancient sites - a real radar).

4. Radar equipment of aircraft and helicopters. They don't fly in close proximity to humans and the radiation from them does not affect us.

5. The main radar is usually in your pocket. It's called «mobile phone». It has omnidirectional antenna, that is, it radiates in all directions. Its capacity isup to 2 watts. The frequencies is 900 MHz and 1800-1900. While talking time it irradiates your brain, particularly the center of decision-making. If wireless headsets are used, the brain is irradiated by Bluetooth (2400 MHz) and a little less power.

The analysis showed that all radars are arranged so as not to cause harm to humans. But direct electromagnetic radar rays are not recommended for a person.

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