

**НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
“КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ ІМЕНІ ІГОРЯ СІКОРСЬКОГО”**

ФАКУЛЬТЕТ ЛІНГВІСТИКИ

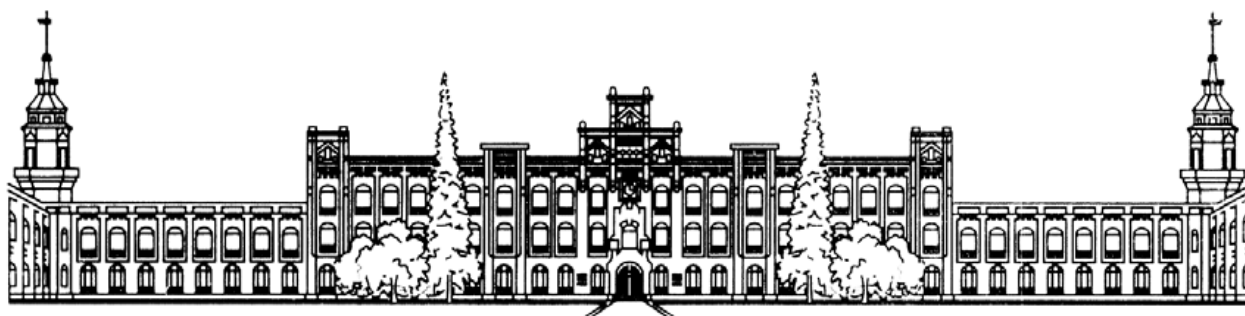
**‘SIGNIFICANT ACHIEVEMENTS IN
SCIENCE AND TECHNOLOGY’**

“ВИЗНАЧНІ ДОСЯГНЕННЯ В НАУЦІ І ТЕХНІЦІ”

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**MAJOR TECHNOLOGICAL BREAKTHROUGHS IN UKRAINIAN
SCIENCE THAT HAVE INFLUENCED THE WHOLE WORLD
(PAST, PRESENT, FUTURE)**

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Few people know that most of the modern inventions that are now actively used around the world were invented in Ukraine. It is difficult to overestimate the importance of these inventions, as they have truly changed the world, are changing it now, and I am sure that new inventions by Ukrainians will change the world in the future.

I am curious to know what technological inventions of Ukrainian scientists from the past have influenced the world today. If we talk about world-famous Ukrainian inventions, we cannot but mention Igor Sikorsky and his helicopter.

Ihor Sikorsky was a Kyiv-based aircraft designer who was the inventor of the helicopter and multi-engine airplane. In 1919, Sikorsky emigrated to the United States, where he founded his own company, Sikorsky Aircraft. In 1924, his first cargo and passenger airplane, the S-29A, was produced, carrying up to 1900 kg of cargo and not requiring a runway. 1939, September 14 – Ukrainian-born aircraft designer Igor Sikorsky flies his first VS-300 helicopter in the United States. Three years later, the U.S. began mass production of the two-seat S-47, which was adopted by the U.S. Army. It was also used in the UK. At the same time, the designer himself believed that the main task of such vehicles was to save people, not combat. And he was sincerely happy when helicopters were particularly effective in search and rescue and sanitation operations. His son Sergiy Sikorsky estimates that his father's machines saved more than a million and a half lives. The last work of the designer was the S-58 helicopter, which was operated in 50 countries.

It is hard to imagine the course of history if the helicopter had not been

invented. Many people might not have been saved and many key historical events might not have happened if it were not for Ukrainian technological science. But Ukrainian technical science has had a global impact not only on the aviation industry. The modern X-ray machine would not have existed without Ukrainians.

Ukrainian scientist Ivan Pului was the first to develop an X-ray tube, which is the prototype of the modern X-ray. This happened 14 years before Roentgen Wilhelm announced a similar device to the world. Ivan Pului was the first in the world to take an X-ray of a human skeleton. His achievements in this field, his research and development, became fundamental for modern X-ray machines. Millions of lives were saved because of the invention of the X-ray machine. It's scary to imagine how many people could have died because of an undetected or misdiagnosed injury or disease.

Today, X-ray machines are used in medicine, at airports and checkpoints, and many other places. The impact of this invention on the world is enormous. And we should remember that without Ivan Pului, none of this would have happened. Unfortunately, Pului did not patent his development and did not become the official inventor of X-rays, but the international community has repeatedly confirmed that it was a Ukrainian who initiated the development of this crucial industry. In particular, Albert Einstein himself expressed a similar opinion.

Ukrainians have made many such large-scale discoveries in the past. For example, Fedir Pirotsky's electric tram (Fedir Pirotsky's electric tram, Volodymyr Melnykov's eco-fuel for cars. (October 28, 2023), Volodymyr Melnykov's eco-fuel for cars, Sergiy Korolyov's first rocket engine (Sergiy Korolyov's first rocket engine. (October 28, 2023), Invention of seawater desalination technology by the Odesa State Academy of Refrigeration, and many more. For many years, Ukrainians have been contributing to the world's technology and now they continue to do so.

The life of people with diabetes is difficult and that is a fact. But a scientist from Zakarpattia, Petro Bobonych, has found a way to make their lives much easier! The man began creating his model of a glucometer in 2002. He invented a glucometer (a device for measuring blood sugar) in the form of a wristwatch and received his

first patent in 2004. With this device, diabetics can check their blood sugar levels at any time without having to donate blood. Obviously, in today's realities, when many people suffer from diabetes, this invention can save thousands of lives!

The Ukrainian technical field of science does not stand still and is actively developing despite any obstacles. In the future, we will see a large number of technical inventions from Ukrainians who demonstrate their scientific and technical potential every day. Given the way Ukrainians are now implementing the production of their own drones and unmanned aerial vehicles during a full-scale war. I am confident that after the victory, the scientific and technological potential of the Ukrainian nation will grow exponentially.

References:

1. 1939, September 14 - Ukrainian-born aircraft designer Igor Sikorsky flies his first VS-300 helicopter in the United States. (October 28, 2023) Retrieved from <https://uinp.gov.ua/istorychnyy-kalendar/veresen/14/1939-gelikopter-sikorskogo-pidnyavsya-u-povitrya>
2. Fedir Pirotsky's electric tram, Volodymyr Melnykov's eco-fuel for cars. (October 28, 2023) Retrieved from https://espresso.tv/article/2015/07/24/top_22_ukrayinskykh_vynakhody__bez_yakyyh_by_ne_isnuvav_svit
3. Sergiy Korolyov's first rocket engine. (October 28, 2023) Retrieved from <https://www.welcometoukraine.info/15-ukrainian-inventions-that-changed-the-world/>
4. Invention of seawater desalination technology by the Odesa State Academy of Refrigeration. (October 28, 2023) Retrieved from <https://visitukraine.today/blog/1875/8-inventions-of-ukrainians-that-are-used-all-over-the-world>

PRE-LICENSING REVIEW OF NEW NUCLEAR POWER DESIGNS, WHAT IT MEANS FOR UKRAINE AND THE WORLD

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With challenges concerning climate change, arise new and unique solutions to de-carbonizing energy. Solar panels, wind turbines, biofuels and other so called “renewable” energy sources currently hold trend for new power stations. However, they come with a few drawbacks such as lack of ability to provide reliable base power. For such applications large plants that are working constantly are best. Such plants include big coal-fired plants, gas-fired plants and nuclear power plants. First two, obviously do not provide carbon free energy, but nuclear might be the answer after all.

With concerns over safety and high price new and new solutions pop up in the nuclear industry – Generation IV. Small Modular Reactors, Micro Reactors, new types of fuels. There are 100s of new projects currently in development. The principle of permissibility (Law of Ukraine, Article 5) requires that all nuclear installation go through a licensing process, for their construction and operation. This process might take quite a lot of time, money and in some cases (for licensing in US (US NRC, 10 CFR 2.704) for example) provide a proprietary information to the public view. For easing of this process additional optional service is often provided by licensors – Pre-licensing.

Pre-licensing is a service that allows for analysis of design on early stages, and allows to rapidly develop systems that are compliant with regulatory requirements. This requires much less money, allows to begin work on licensing topics much earlier, and provides safety to proprietary secrets of plant designers. Currently there are quite a few countries that provide pre-licensing overview: United States with Nuclear Regulatory Commission (US NRC Site, 2023), Canada with Canadian Nuclear Safety Commission (CNSC Site, 2023), United Kingdom and as of recently

Ukraine through State Nuclear Regulatory Inspectorate of Ukraine. Ukraine is a newest addition to pre-licensing service “family”. The basis of pre-licensing is borrowed from Canadian experience in its Vendor Design Review program (SNRIU Site, 2023).

The pre-licensing process is often committed in several stages. For this example, have been taken Canadian process as it is the one which will be used in Ukraine. The process is divided into 3 phases (CNSC Site, 2023):

- Phase 1: Initial Evaluation of Regulatory Compliance: This initial phase includes a comprehensive evaluation of the vendor's nuclear power plant design in comparison to the latest CNSC design requirements for new nuclear power plants in Canada.
- Phase 2: In-Depth Assessment of Licensing Feasibility: In this phase, we delve deeper into the design, with a specific focus on pinpointing any fundamental obstacles that might impede the licensing of the vendor's nuclear power plant in Canada.
- Phase 3: Post-Assessment Actions: Phase 3 provides the vendor with the opportunity to address specific findings from Phase 2, allowing for corrective actions and adjustments as necessary.

For Ukraine it opens a new market, and allows for faster appropriation of new nuclear technologies and experience with it. Regulators now will be able to familiarize themselves with brand new technologies, acclimatize to new approaches in nuclear energy, and develop new and relevant regulations for advanced nuclear power technologies.

As a conclusion: with new, safe and ecological technologies comes new need for fast iteration and development, the approach of pre-licensing allows for nuclear technologies to be in line with the regulation right away with adoption of said technologies. These activities serve as a crucial foundation, not only for ensuring the safety and security of nuclear power plants but also for fostering public trust and confidence in the nuclear energy sector.

References:

1. Law of Ukraine “On licensing activities in the field of nuclear energy use”. Retrieved from <https://zakon.rada.gov.ua/laws/show/1370-14#Text>
2. United States Nuclear Regulatory Commission Site. Retrieved from <https://www.nrc.gov/about-nrc.html>
3. Canadian Nuclear Safety Commission Site – Pre-Licensing Vendor Design Review. Retrieved from <https://nuclearsafety.gc.ca/eng/reactors/power-plants/pre-licensing-vendor-design-review/>
4. The Board of the State Nuclear Regulatory Inspectorate of Ukraine adopted the document on the possibility to conduct a pre-license assessment of projects of new nuclear facilities (2023, October 25). Retrieved from <https://snriu.gov.ua/en/news/the-board-of-the-state-nuclear-regulatory-inspectorate-of-ukraine-adopted-the-document-on-the-possibility-to-conduct-a-pre-license-assessment-of-projects-of-new-nuclear-facilities>

PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Recently, artificial intelligence (AI) has amazed humanity with its capabilities. Thanks to this, significant progress has been made, and it has fundamentally changed our lives. AI has not been used from all perspectives; rather, it can be called the beginning. The world looks forward to the exciting new advances and breakthroughs that AI will bring. It's only clear that it has to be something fantastic because people expect even more.

Experts estimate that as much as 90 percent of online content may be synthetically generated by 2026 (Maggie Harrison, 2023). Such statistics highlight the prospects for the use of artificial intelligence in one of the industries where it is used. In general, artificial intelligence is used in education, medicine, industry, the public sector, smart homes, transport, etc.

Considerable progress in artificial intelligence is expected in health care. Smart programs can already determine vital signs and send this data to the doctor. Also, almost all information is already in digitized form. Searching for medicines on the required shelf in the pharmacy takes a few clicks. In the near future, artificial intelligence will be able to make 3D visualizations of computer tomography, which will help predict ischemic heart diseases in cardiology and reduce the risk for the patient's health. In dentistry, neural networks will be able to detect caries as well as facilitate the choice of a treatment method. Artificial intelligence can become a surgeon's assistant. There are no less innovative ideas in ophthalmology and pediatrics.

In the educational process, AI has successfully proven itself in its application on educational platforms, in the development of chatbots, etc. It has already become possible for artificial intelligence to make a report, presentation or even test in a matter of minutes. Unfortunately, today's artificial intelligence has made it possible for academic dishonesty to increase. Although there are many other ideas that, on the contrary, will allow those who want to get information for professional training, for example, artificial intelligence will help people with vision problems voice the text from a book, picture, or video. It will also be possible to remotely assess students' emotions to help determine who is having a hard time or who is bored. AI makes learning more interactive and accessible.

Transport and electronics are another important field of application for artificial intelligence. Unmanned transport, smart roads and stops are no longer new for us. But there are no less interesting ideas for the use of artificial intelligence. AI-based navigation systems can help blind people navigate cities more safely. Applications will be able to provide real-time audio recordings of the environment for the impaired hearing. AI can help reduce carbon footprints. Sensors will be able to monitor air quality, and systems will be able to optimize energy consumption. Also, neural networks will be able to recognize faces in public transport to identify passengers and detect potential threats.

Automation and robotics have already changed such industries as logistics. But

artificial intelligence goes further. A humanoid robot as Sophia is the basis for robotics and artificial intelligence research. She is the first robot citizen and the first robot ambassador. She can talk and express her thoughts, make facial expressions like a real person. On the one hand, this is exciting, and on the other hand, what will happen if robots replace people? The fact is that humans will be working alongside robots in the near future. They can even surpass people in such aspects as productivity, safety, and efficiency.

So, artificial intelligence has impressed us with its efficiency and ease of use, but this “artificial brain” will open many possibilities that have not yet been discovered. AI is ready to continue its transformational journey. Improvements in programming, expanding intelligence, advances in health care, automation and robotics, education, and the integration of artificial intelligence with the Internet are among the exciting predictions for the next few years. Implementing these advances will open up new opportunities and propel us toward a future where artificial intelligence will play an integral role in shaping our lives.

References:

1. Ben Hartwig. Top 11 Benefits of Artificial Intelligence in 2023. Retrieved October 20, 2023, from <https://hackr.io/blog/benefits-of-artificial-intelligence>
2. Maiia Marienko. Artificial intelligence and open science in education. (2023, p. 48-53). Retrieved October 20, 2023, from <https://lib.iitta.gov.ua/734475/1/2023-381-marienkokovalenko.pdf>
3. Mike Thomas. "The Future of AI: How Artificial Intelligence Will Change the World". Built In. (2023, March 03). Retrieved October 20, 2023, from <https://builtin.com/artificial-intelligence/artificial-intelligence-future>
4. Stefaan Verhulst. “Experts: 90% of Online Content Will Be AI-Generated by 2026”. The living library. (2023, Posted on August 29). Retrieved October 20, 2023, from <https://thelivinglib.org/experts-90-of-online-content-will-be-ai-generated-by-2026/#:~:text=%E2%80%9CExperts%20estimate%20that%20as%20much,or%20manipulated%20using%20artificial%20intelligence.%E2%80%9D>

PROSPECTS FOR ARTIFICIAL INTELLIGENCE: ANALYSIS, CHALLENGES AND RECOMMENDATIONS

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In recent years, artificial intelligence has become one of the most innovative and promising fields. Its rapid development and integration into various aspects of human life have raised important questions about the advantages and disadvantages it can create. In this paper, we reviewed the prospects for artificial intelligence, covering its potential benefits, ethical issues, economic impact, and societal implications. The goal is to provide a comprehensive view of the opportunities and challenges presented by AI as it continues to shape the future.

Artificial intelligence has great potential to influence the global economy. It automates routine tasks, helps with decision-making through predictive analytics, and can significantly increase labor productivity by taking on simple and routine tasks, and these are just a few ways AI can contribute to economic growth. It is expected that the use of artificial intelligence will create new jobs, and can help in the transformation and improvement of existing conditions. However, this economic growth can be uneven and have a number of problems, and there is a need for policies that can address aspects such as displacement and job cuts. To date, AI is already used in many areas, but there are still no specific laws that would regulate its use.

Artificial intelligence (AI) is having a significant impact on the economy and the labor market. On the one hand, the automation of processes thanks to AI leads to increased productivity and efficiency in various industries. On the other hand, it can lead to transformations in the labor market, where certain types of work may be automated, which will require re-skilling and re-training of workers. In addition, there is a need to create new jobs related to the development and management of AI systems. Thus, the impact of AI on the economy and the labor market requires careful analysis and strategic planning to ensure sustainable development.

One of the most important aspects is the transparency and openness of the algorithms used in AI systems, as this determines the possibility of tracking and understanding the decisions made. In addition, it is important to avoid bias and discrimination in the decision-making process of AI systems, as this can lead to negative social consequences. Ensuring the privacy and security of data processed by AI systems is also a key aspect to avoid possible privacy breaches. All this requires the development of ethical standards and regulations that will guide the use of AI in various spheres of society.

The risks and challenges associated with the development of artificial intelligence (AI) represent an important problem for modern society. First, there is a threat of automation of a large number of jobs, especially in areas where routine tasks can be performed by AI algorithms. This can lead to social challenges related to unemployment and instability in the labor market. The second significant risk is privacy and data security issues. AI can have access to vast amounts of personal information that can be used by unscrupulous individuals or agencies. This highlights the need for strict rules and regulations regarding data processing and storage, and also forces the development of strategies and regulations to regulate the development of AI and ensure its responsible use.

First, it is necessary to develop a clear legal framework for the collection, processing and storage of data, especially personal information, used in AI systems. This will help prevent potential privacy breaches and data leaks. The second important aspect is the definition of responsibility for AI actions. This means solving issues related to possible errors or incorrect decisions made by the system, as well as determining possible ways to correct these situations. In general, effective regulation of AI will help ensure a balance between the development of this technology and the preservation of ethical and legal norms. This will contribute to the sustainable and safe implementation of artificial intelligence in modern society.

Artificial intelligence has incredible potential to transform modern society. However, it is important to realize that its impact can be both positive and negative, so the ethical and responsible use of AI is of the utmost importance. Collaboration

between governments, industry experts and the public are needed to develop effective strategies and regulations for AI in the future.

References:

1. Future of AI (Artificial Intelligence): What Lies Ahead? (2022, March 23) Retrieved from <https://www.simplilearn.com/future-of-artificial-intelligence-article>
2. Challenges and opportunities of Artificial Intelligence for Good (2018, October 17) Retrieved from <https://aiforgood.itu.int/challenges-and-opportunities-of-artificial-intelligence-for-good/>

EFFECTIVE METHODS OF FOUNDATION SCIENCE: GPS MONITORING OF FOUNDATIONS

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One of the areas of modern applied geodesy is deformation monitoring. This concept includes geodetic monitoring of settlements and deformations of foundations, as well as other important elements of buildings and structures.

Inquiry of the anamorphosis of engineering architecture equally bridges or buildings are important tasks for civil engineers. Of course, all civil engineering structures are susceptible to deterioration over a period of time. Particularly, deterioration due to changes in groundwater matched, phenomena: tidal and tectonic, landslide or other catastrophes. Continuous monitoring of such structures is so important as it provides information, determines the character of the construction, disclose risky areas and offers safety measures to be taken.

The foundation of a building is designed to support significant gravity loads and typically consists of concrete posts, trellises or caissons that are driven into the ground.

There are many methods for measuring the vibration or displacement of structures: accelerometer, laser interferometer and electronic distance measurement.

Accelerometer measurement is the standard method. It is very light, small in size and has a minimal effect on the properties of the vibrating system. However, this requires direct sensor contact with the structure and the necessary wiring to connect the accelerometers to the central recording device. The wiring may be damaged. An accelerometer does not have the opportunity to measure the swing of the total vibration of the structure because acceleration cannot be obtained.

Traditional methods are limited and do not meet the requirements of monitoring large structures in terms of continuity, real-time and automation.

Operational monitoring of large structures can be easily achieved using GPS technology. Over the past decade, GPS technology has undergone significant developmental advances.

- GPS technology overcomes the limitation of climate and measures the structure displacement in three-dimensional directions;
- GPS positioning belongs to satellite positioning,
- can measure the structure displacement in three-direction,
- has a high degree of automatization,
- this opens up the possibility of observing the dynamic characteristics of a large structure near real time

With the latest advances in complete integrated satellite constellation and the use of specialized satellite signal processing software, it is possible to obtain highly accurate measurement of base vectors with millimeter accuracy using a geodetic GPS receiver.

This information will always be available to the system manager in system mode. When a certain predefined shear level is exceeded, the response of the structure can be evaluated based on the achieved shear values or the changed dynamic characteristics. In case of an alarm, the system manager can have a solution, for instance, close the construction for next checkup.

It is clear that the GPS technique, in conjunction with modern analytical tools, can provide excellent data about the condition of structures and become part of a program of monitoring and inspection of major structures throughout the world.

Geodetic monitoring of buildings and structures is very important in the course of their operation. It helps to detect deviations from the norm in a timely manner.

Over a long period of time, monitoring can also provide an opportunity to detect "anomalies" or "innovations" that may signal unusual loading conditions or altered structural behaviour, which in extreme cases can lead to destruction.

References:

Akib, W.A.A.W.M., Kok, S.K., & Amin, Z.A. *High Rise building deformation monitoring with GPS*. Retrieved from <https://core.ac.uk/download/pdf/11777991.pdf>

Cheng, P., Shi, W.J., & Zheng, W. *Large structure health dynamic monitoring using GPS technology*. China, Hong Kong. Retrieved from https://www.fig.net/resources/proceedings/fig_proceedings/fig_2002/TS6-2/TS6_2_cheng_etal.pdf

Mayunga, S.D. (2021). *Dynamic deformation monitoring of Lotsane bridge using global positioning systems (GPS)*. Retrieved from <https://www.scirp.org/journal/paperinformation.aspx?paperid=107514>

CHALLENGES AND OPPORTUNITIES IN INTEGRATING AI INTO ARCHITECTURAL PRACTICES

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The convergence of artificial intelligence (AI) and architectural practice is revolutionizing and transforming the construction industry. In a world characterized by rapid urbanization and complex design needs, AI offers compelling solutions to many of the challenges architects currently face. The importance of AI in architecture lies in its potential to reshape architectural practice, improve the design process, and facilitate the creation of more sustainable and efficient structures. To maximize the potential of AI for the benefit of the construction industry, we need to fully

understand the challenges and opportunities this convergence will bring.

Challenges and opportunities for AI integration. In construction, there are complex issues related to sustainable design, space efficiency, and energy-efficient buildings. However, there are technical and conceptual barriers to AI integration. Construction companies are often hesitant to adopt new technologies, and the creative and ethical implications of AI need to be thoroughly examined.

AI can revolutionize architectural practice by automating repetitive tasks, simulating and optimizing designs, and providing valuable insights into sustainability and resource efficiency. This can enhance creativity and productivity in architecture. While the architectural community recognizes the potential benefits of AI, there is a lack of research on its practical applications and ethical considerations.

Enhancing Architectural Design with Adaptive AI. In order to develop and implement an intelligent design assistant that can adapt to the characteristics of the architect, the system must be able to identify the steps taken by the architect with respect to a specific design intent. By accessing the internal dialog between the architect and the sketch, the system aims to suggest appropriate next design steps and predict possible biases and weaknesses in the architect's design decision-making process. Through a multidisciplinary approach, the system applies methods from computer science, design theory, and human-computer interaction (HCI) at the intersection of AI and architecture to ultimately predict and suggest further design steps.

The AI Revolution in Architectural Design. The 2010s saw the emergence of a number of AI-powered design and analysis tools, such as Spacemaker, TestFit, and Kreo, that use AI and machine learning algorithms to generate design solutions, optimize building performance, and improve construction processes. These developments have ushered in a new era of AI-driven architecture, and AI is becoming an indispensable weapon for architects.

In summary, this paper integrates key research findings and emphasizes the need to effectively integrate the challenges and potential benefits of AI into architectural design. It emphasizes the importance of ethical considerations and

argues for a balanced approach to harness the potential of AI while maintaining the creativity that characterizes architecture. Finally, the paper aims to contribute to a better understanding of the integration of AI in architectural practice and to stimulate further research and practical applications in this area.

References:

1. D., Malyska, N., Streilein, B. (2019). Artificial Intelligence: Short History, Present Developments, and Future Outlook, 75-103.
2. Jaruga-Rozdolska, A. (2022). Artificial intelligence as part of future practices in the architect's work: MidJourney generative tool as part of a process of creating an architectural form, 96-103.
3. Bielski, J., Eisenstadt, V. (2022). The Morphological Echo of Architects Concept for a Conversational Artificial Intelligence to Support Architects during the Early Design Stages, 429-436.

ARTIFICIAL INTELLIGENCE IN ART AND MARKETING

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With the development of information technology, consumption in art markets has accelerated, as Internet technologies facilitate the exchange of information and new business models strengthen the established art ecosystem of consumption.

International contemporary art, over the past thirty years, has become thrive in a rapidly changing and global environment. Internet technologies have enabled instant communication and information exchange, connecting users across the globe. This large-scale transformation has a direct impact on the organization of art production and consumption. Production and consumption are no longer closely linked to cities.

Art institutions are increasingly using new media to showcase and promote their collections, seeking to create unique experiences. Artists are engaging with social media as cultural branding intensifies in the digital age, and experiments with new media generate art forms that push the boundaries of contemporary art.

Technology is making it easier to work and collaborate in the world, and the art business is creating a favorable environment for the development and application of technology. In other words, technology, business, and culture are coming together to promote art and provide buyers and viewers with a better experience. Indeed, AI (artificial intelligence) is actively used, for example, as a powerful tool in photo processing in «Photoshop» and other similar platforms.

However, as artificial intelligence is now the basis of the third technological revolution, more and more art critics fear that AI may replace human-made art and thus devalue artistic manifestations as a phenomenon.

As you know, artificial intelligence uses the so-called machine learning, the basic principle of which is to analyze the available information, which the AI reproduces and adapts upon request, which is not only unethical but also, in fact, a violation of intellectual property rights, which, in particular, is in force in Ukraine.

Nowadays, sadly, more and more companies prefer AI to live artists, because, in most cases, they don't have to pay it. For example, “METRO Ukraine” is using AI to develop a part of the household catalogue (Oszyk, 2023), which caused a certain resonance in the network, as it encourages other companies to use such technologies directly in their projects, thus not spending significant funds on the work of artists. As a result, the demand for artists' work is significantly reduced, which affects the spread of culture.

It has also been repeatedly noticed from our own experience that companies of various sizes around the world use AI to write their marketing texts, thus bypassing the need for marketers and copywriters.

In contrast to the above, we should note that AI has good potential when used responsibly. As Chako noted, Artificial intelligence and machine learning provide critical customer insights from a variety of perspectives that can help make strategic

marketing decisions, including a deep understanding of audience sentiment toward the brand, as well as a full audit of customer service team's performance and social media engagement. This may help adapt to changing market trends and prioritize your budget based on which aspects require the most investment. The author also correctly noted that artificial intelligence tools can help identify opportunities to improve products and offers, as well as fill gaps in the market. Recognizing the share of voice of theoretical competitors will help find ways to be flexible in a competitive market. In addition, it is possible to compare social indicators with those of competitors using competitive benchmarking. This will allow to maneuver the company's social strategy accordingly or adjust the indicators to maintain a competitive advantage. (Chako, 2023)

To summarise, humanity is currently in the process of the third technical revolution and AI can be used as a good tool in the same marketing, taking into account the ethical and social consequences. So, like it or not, people must adapt to and accept the realities of today, and not reject technology, but use it wisely and with ethical considerations.

References:

1. Osyik D. (November 11, 2022) Metro Ukrayina stvoryla fantastychnyy katalog za dopomohoyu shtuchnoho intelektu. [Metro Ukraine has created a fantastic catalog using artificial intelligence] Metro Україна створила фантастичний каталог за допомогою штучного інтелекту. Retrieved from <https://rau.ua/novyni/novini-partneriv/metro-ukraina-stvorila-katalog/> in Ukrainian
2. Chacko A. (May 9, 2023) The role of artificial intelligence in marketing. Retrieved from <https://sproutsocial.com/insights/ai-marketing/>

TECHNOLOGICAL BREAKTHROUGHS IN PRESENT-DAY UKRAINE

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Nowadays, new discoveries are made and new technologies are explored every day in the world. Despite the war, Ukraine is no exception and continues to surprise the world with its new breakthroughs.

One of the most significant breakthroughs in recent years is the development of AI-based security systems. The Ukrainian government has invested heavily in artificial intelligence research to improve speech recognition programs, combat terrorism, and provide security.

Since the beginning of the full-scale war, Ukraine has made many discoveries in the military sector. The most important one is the drones. They have been used to gather intelligence, conduct surveillance, and provide real-time information to troops. Now a lot of companies are producing drones of different types and purposes.

One of the most advanced and latest drones that have been developed is a “stealth” strike drone (Backfire K1). This flying object is invisible to the electronic warfare equipment of our enemies, so it can accurately hit the target.

Electronic warfare system is a recently developed anti-drone system that has already been tested and will be ready to work in the near future. The work of this system is that it creates electronic interference, that helps to detect and counter hostile UAVs (Unmanned Aerial Vehicles). The system is made in such a way that it will be easy to fix if the need arises.

Because of this situation in our country a large amount of land is contaminated by mines. But our smart scientists and engineers developed a “Landmine detection platform”. This platform uses AI, satellites, and drones, specializes in detecting unexplored rockets and mines, which cannot be seen with the naked eye. When the dangerous thing is detected, the program marks it on the map, after which it can be neutralized.

In addition to military aggression, our country suffers from “online war”. To prevent unwanted consequences our country started to work with international partners to develop cybersecurity strategies and improve its capabilities.

Despite such a difficult time our people continue making new discoveries in different fields of science and life in general. For example: not so long ago we started using 3D printing technology to produce medical equipment, prosthetics, and even entire houses.

Another notable breakthrough was made in space exploration. Our scientists have developed their own space agency and launched several satellites into orbit.

References:

1. Darrell, M. (2018). How artificial intelligence is transforming the world. Retrieved from <https://www.brookings.edu/articles/how-artificial-intelligence-is-transforming-the-world/>
2. Kelsey, D. (2022). How technology, both old and new, has shaped the war in Ukraine so far. Retrieved from <https://www.popsoci.com/technology/technology-russia-ukraine-war/>
3. “Explosive” Growth of digital technologies creating new potential for conflict, disarmament chief tells security council in first-ever debate on cyberthreats (2021). Retrieved from <https://press.un.org/en/2021/sc14563.doc.htm>
4. Aridi, A., Radosevic, S. (2020) How Ukraine can upgrade its technological capabilities. Retrieved from <https://www.brookings.edu/articles/how-ukraine-can-upgrade-its-technological-capabilities/>
5. Bacchi, U. (2022). Here are 5 ways technology is being used to help Ukraine. World Economic Forum. Retrieved from <https://www.weforum.org/agenda/2022/03/russia-tech-business-conflict-ukraine/>

RENEWABLE ENERGY INDUSTRY IN UKRAINE AFTER THE WAR

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As a result of the war with Russia, Ukraine has suffered losses in the renewable energy sector, but the experience of developing this industry in 2015-2019 shows that it can become an attractive investment. Current EU climate policy requirements and global trends in sustainable development only confirm this potential. According to the NEURC, as of December 31, 2021, Ukraine had an installed renewable energy capacity of 9,655.9 MW (Konechenkov & Omeljchenko, 2022).

In 2021, the share of electricity generated from renewable energy sources amounted to 8.1% or 12.8 TWh. Of this amount, 56% was generated by solar energy, 33% by wind energy, almost 8% by biomass and biogas combustion, and 3% by small hydropower (Konechenkov & Omeljchenko, 2022). Therefore, the development of renewable energy should be a key factor in the recovery of the Ukrainian economy and ensuring the country's energy security.

The real way to ensure energy security is to develop renewable energy sources, not nuclear power. The events of recent months show the need to restructure the energy sector and decarbonize it. By 2030, at least 45% of electricity should come from renewable sources, and the share of renewable energy sources in the final use of energy, including transportation and heating, should be at least 35% (Krynycjkyj, 2022).

A new green industrial partnership between Ukraine and the EU is needed to rapidly deploy solar and wind technologies across the country. This partnership will help create the market confidence needed to attract investment.

A renewable energy partnership between Ukraine and the EU would open up new opportunities for the whole of Europe (Vyshnycjka, 2023). In the short term, it will help Ukraine recover from the war and rebuild its energy sector and economy. In the medium term, it will allow for a sharp reduction in emissions from the energy

sector, a gradual phase-out of coal by the early 2030s, and the safe decommissioning of nuclear power plants as energy storage technologies and solutions to increase grid flexibility become more widely available. For example, the Energy Strategy of Ukraine until 2035 envisages the possibility of reaching a 25% share of renewable energy sources by 2035, as they will develop the fastest compared to other sources of generation.

References:

1. Konechenkov, A., Omeljchenko, V. (2022, 22 November). Sektor vidnovljuvanoji energhetyky Ukrainy do, pid chas ta pislja vijny [Ukraine's renewable energy sector before, during and after the war]. Razumkov centr. Retrieved from <https://razumkov.org.ua/statti/sektor-vidnovlyuvanoyi-energetyky-ukrayiny-do-pid-chas-ta-pislya-viyny>

2. Krynychkyj, K. (2022, 21 April). Vidnovljuvana energhetyka – kljuch do vidbudovy ekonomiky ta energhetychnoji nezalezhnosti Ukrainy [Renewable energy is the key to economic recovery and energy independence in Ukraine]. Ekonomichna pravda. Retrieved from <https://www.epravda.com.ua/columns/2022/04/21/686045/index.amp>

3. Vyshnycjka, A. (2023, 22 February). Chomu vidnovljuvana energhetyka — ce zaporuka bezpeky dlja Ukrainy pid chas ta pislja vijny [Why renewable energy is a guarantee of security for Ukraine during and after the war]. Heinrich-Böll-Stiftung. Retrieved from <https://ua.boell.org/uk/2023/02/22/chomu-vidnovlyuvana-enerhetyka-tse-zaporuka-bezpeky-dlya-ukrayiny-pid-chas-ta-pislya>

TRUE LIBERATION FROM FUEL DEPENDENCE.

THE IMPORTANCE OF THE DEVELOPMENT OF RENEWABLES

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Energy is a universal resource that civilization needs more and more every day.

No modernized process would be possible without electricity. Humanity needs warmth, safe working conditions, and strives for productive work. Annually, the average consumption of electricity per capita is growing significantly. Every particle of the universe is permeated with energy. Today, we can generate energy out of thin air. The extraction of fossil fuels has given us extraordinarily rapid access to vast volumes of this irreplaceable resource. But it also took away some of our freedom, putting a monopoly on what is everywhere in the hands of those who are not too concerned about the future of others. Moreover, paradoxically, it is precisely because of this “great opportunity” of fossil fuels that some countries are declining. There is no need in the development of a nation when you can sell the earth’s resources and ensure your comfort. There is no need for democracy if power and wealth are already in your hands. This is not only about solutions and the economy. It is also about natural and sustainable living, without craps and conscience deal. It is necessary to realize the real impact of non-renewable energy on our lives. Draw cause-and-effect relationships with much longer links. Analyse the problem more deeply and remember the price of today’s compromises.

Fortunately, developed countries have made significant progress in the development of renewable energy in recent years. Nevertheless, these steps are not enough for a comfortable future. It is generally accepted that certain innovative green solutions are currently too expensive to implement. Another though is that the population cannot afford a sudden transition from coal to solar batteries or from gas to hydrogen, for example. However, it is worth facing the truth. Each of us pays an emission tax every day. We pay with our lungs, our medical bills, and even our lives when someone has power and control over energy flows to billions of people. Decentralization of energy systems and generation of renewable energy is not a luxury – it is a necessity.

Existing solutions and research reflect that humanity can fully provide for itself without further depletion of natural resources. World organizations do not ask the main question of opportunity, but time and price. However, planning for tens or hundreds of years is too optimistic. The modern resource allocation system may not

leave us much time to implement solutions. We need them today. If ten years ago advanced states were as focused on this goal as they were on the development of the military sphere, perhaps today we would be facing completely another challenges. But in reality, almost every country is still dependent not only on natural circumstances and internal factors but also on external crises, on the crises of other countries. Instead of having productive multinational cooperation, we are forced to limit ourselves to transnational races for resources. That, in turn, reduces the overall development productivity of absolutely every country and person.

Today, in times of powerful development of the electric power industry, the world consumes more wood and charcoal than ever before. In 2022, global coal-fired power generation exceeded the all-time high of 2013 (Belousova, 2022). World coal consumption reached 8 billion tons per year. At the same time, in 2022, the share of renewable energy reached a record 12% (Chepur, 2023).

Total primary energy supply per capita increased from 1.65 to 1.82 tons of oil only from 2000 to 2008, which is more than 10 (OECD 2010).

Global emissions of CO₂ from the combustion of minerals increased from 534Mt in 1900 to 9.15 Gt in 2010 (Smil, 2017).

The energy value of products of animal origin is 4 times lower than the food fed to animals, and overeating also leads to additional energy and financial costs due to the deterioration of health. Therefore, approaching the issue comprehensively, one should not forget about regulating the consumption not of only electricity, but also other spheres of life.

It is also necessary to improve people's awareness of the energy efficiency of premises.

However, in one way or another, human needs for energy are constantly increasing. The relentless growth of energy needs is a well-known fact, but none of us can predict how this growth will be reconciled with a world of economic inequality and environmental problems. (Smil, 2017) And here renewable sources should work to help us. And in this, too, it is necessary to apply a comprehensive approach. Combining the development and use of solar energy, wind energy, hydroelectric

power plants, geothermal energy, the creation of new, more energy-intensive and with reduced storage losses, batteries, and the development of hydrogen infrastructure. The latter is also due to the still partial unreliability of electricity supply and the need to ensure continuous access to energy for critical infrastructures.

The effectiveness of such work can be increased by the open exchange of developments between countries and the joint refinement of technologies. In turn, it should be supported by states both politically and financially.

Based on this, in my opinion, one of the main tasks of today is to unite over the urgent introduction of renewable energy as a source of energy freedom available to everyone. Exchange of research and experience in this area, recalculation of real efficiency losses on existing sources, and enhanced cooperation in the development of new energy infrastructures should become a priority.

References:

- Belousova, K. (2022). *Global coal use reached record levels in 2022*. Retrieved from <https://ecopolitic.com.ua/en/news/u-2022-roci-svitove-vikoristannya-vugillya-syagnulo-rekordnih-znachen-2/>
- Chepur, D. (2023). *Svit vkhodyt v epokhu chystoi enerhii. Chastka zelenoi enerhetyky dosiahla rekordnykh 12% [The world is entering the era of clean energy. The share of green energy reached a record 12%]*. Retrieved from <https://forbes.ua/news/zelena-energetika-zabezpechue-12-svitovikh-potreb-zvit-12042023-13001>
- OECD (2010). *Economic, Environmental and Social Statistics*. Retrieved from https://www.oecd-ilibrary.org/economics/oecd-factbook-2010_factbook-2010-en
- Smil, V. (2017). *Energy and Civilization: A History*. 552.

ENERGY SAVING TECHNOLOGIES

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Energy conservation represents a modern technological trend and a vital response to the rising cost of energy and increasingly stringent environmental demands. In the expenditure breakdown of a typical commercial building, energy costs make up around 30%. In certain industries like metallurgy, chemicals, and petroleum refining, the proportion of energy expenses in the product's total cost can even reach 60%. Hence, a thoughtfully devised energy conservation initiative can considerably cut costs and streamline budget management. (Shen, 2019)

The primary focus in the worldwide energy sector is the adoption of alternative and sustainable sources like solar, wind, water, and biofuels. In the case of Ukraine, there is also a pressing need for the utilization of agricultural and industrial waste, pellets, as well as the modernization of gas boilers. (Shen, 2019)

Lighting constitutes nearly 20% of the world's energy consumption. The current standard practice involves replacing incandescent bulbs with LED lights, resulting in a potential 5-7 times reduction in energy usage. Despite their initial higher cost compared to incandescent bulbs, LED lighting elements offer a significantly longer lifespan of 7-10 times. One notable drawback of LED lighting is the presence of mercury, which necessitates proper bulb disposal planning. (USAID, 2019)

The next phase in cutting lighting expenses of energy may involve the installation of light and motion sensors, alongside optimizing the use of natural daylight. By incorporating various sensors, it becomes possible to automatically adjust lighting brightness and switch off lights when spaces are unoccupied. In certain scenarios, this approach could yield an additional 20% in energy savings.

Air conditioning and ventilation systems are widely employed for regulating indoor environments. The predominant approach to cost reduction with these systems involves the implementation of heat recovery systems. By ensuring precise calibration and regular maintenance, potential cost savings of up to 10% can be achieved. While it is preferable to integrate such systems during the initial construction of a building, there are situations where retrofitting becomes necessary for existing structures. In these cases, seeking guidance from seasoned designers is

essential to accurately assess all parameters and install the system in the most efficient manner. (USAID, 2019)

Water supply: A commonly employed method for water conservation involves the collection and treatment of rainwater for future use within a structure. This strategy is primarily applicable in areas where rainfall is frequent and there are no freezing temperatures during the winter. In most developed nations, the use of automated water supply sensors and harnessing the residual heat transfer capacity for water heating are pertinent practices. (Enepro X, 2019).

Alternative sources of electricity are witnessing a rapid evolution in response to the growing demand for sustainable and energy-efficient solutions. Individuals, particularly in residential settings, are now empowered to harness these alternatives and contribute to energy conservation. One notable avenue is the ability to sell excess electricity generated through renewable sources back to the grid at favorable "Green" tariffs. This arrangement not only encourages the adoption of renewable energy technologies like solar panels and wind turbines but also fosters a culture of energy frugality among individuals. Homeowners who invest in solar panels, for instance, can not only power their households but also generate surplus electricity when the sun is shining abundantly. This surplus energy is then seamlessly integrated into the grid, reducing the overall demand for non-renewable energy sources. (Enepro X, 2019)

Energy-saving technologies are revolutionizing the automotive industry, ushering in a new era where electric vehicles (EVs) and hybrid systems are gaining remarkable traction. This transformative shift is driven by an acute awareness among consumers and manufacturers of the pressing need to curtail fossil fuel consumption, not only for economic and environmental reasons but also as a response to the global call for sustainability. (International Energy Agency, 2019)

Household appliances such as washing machines, dryers, dishwashers, dehumidifiers, refrigerators, and freezers have made significant strides in energy efficiency, resulting in both reduced environmental impact and cost savings for

consumers. These innovations are achieved through advanced technologies, improved insulation, and optimized operation modes, contributing to a more sustainable and affordable home environment. (USAID, 2019)

Energy-efficient motors and pumps represent a crucial aspect of modern industrial and commercial processes, as well as numerous household applications. These technologies have evolved to reduce energy consumption, operational costs, and environmental impact. Through innovative engineering, enhanced materials, and smart control systems, these devices are leading the way toward a more sustainable and resource-efficient future. (Institute for the study of human knowledge, 2023)

In conclusion, the world of energy-saving technologies is not just a realm of innovative engineering and cutting-edge solutions; it is the key to a sustainable, economical, and environmentally responsible future. From the adoption of LED lighting to the embrace of electric vehicles, from the widespread use of heat recovery systems to the implementation of smart grids and sensors, these technologies hold the promise of transforming the way we produce, consume, and think about energy.

References:

1. Shen (2019, 30 August). Energy-saving technologies. Retrieved from <https://shen.ua/obzor-i-analitika-otrasli/energoseberegajushie-tehnologii-razbiraemsja-analiziruem/>
2. United States Agency for International Development [USAID] (2021, 21 September). Retrieved from <https://www.usaid.gov/energy/efficiency/basics/technologies>
3. ЕнергоХ (2019). Retrieved from <https://energox.com.ua/energoaudyt/korysni-statti/korotkyj-oglyad-energozberigayuchykh-tehnologij/>
4. International Energy Agency (2019, 20 November). Retrieved from <https://www.iea.org/programmes/electric-vehicles-initiative>
5. Institute for the study of human knowledge (2023). Retrieved from <https://humanjourney.us/sustainable-energy-section/energy-efficiency-and-sustainability/>

ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Environmental problems of Ukraine's water resources begin much earlier than June 6, 2023. The territory of our country is covered by an extensive network of rivers, over the past 10 years the quality of water in which has not decreased enough, and in some cases, there are talks about the general impossibility of using the banks of small and large rivers, not only as sources of fresh water, but also for recreation and recreation.

For example, precisely for this reason, after the Russian army blew up the „Dnipro – Mykolaiv” water pipeline, which at that time passed through the temporarily occupied Kherson region, from April 2022 until today, the city with a population of approximately 500,000 was forced to take water from the Buzki Liman and the Southern Bug River.



The results of the destruction of the water pipeline “Dnipro – Mykolaiv”

According to the research of the „Black Sea National University named after Petro Mohyla”, it was determined that the category of water quality by the components of the salt composition in the pre-war period is 6.1, which is less than in 2022 (6.5); according to tropho-saprobological indicators (environmental and sanitary) - the pre-war period is 4.3, which is less compared to 2022 (5.0); according to specific indicators - in prewar times it is less and is 4.7 compared to 2022, when this index was 5.0. All defined surface water quality classes correspond to the degree of pollution "dirty" or "very dirty" and the state "poor" or "very poor". During the studied period, there is a steady trend towards a gradual increase in hardness, dry residue, sulfates, and chlorides in surface waters. (Assessment of the state of surface

waters within the city of Mykolaiv under wartime conditions 2023. p.80)

The explosion of the Kakhovka Dam on June 6, 2023 worsened the ecological condition not only of the rivers, but also of the entire region. This is what the journalists of The New York Times write about it: “Thousands of people were displaced by flooding from one of the world's largest reservoirs, which was vital for irrigating farmland considered the breadbasket of Europe. The disaster puts global food supplies for millions at risk and could threaten fragile ecosystems for decades.” And that’s not all, the bloom of water, a mass plague of fish, pollution of the bottom of reservoirs.



The Kakhovka Dam was destroyed by the Russian army June 6, 2023.

The ecological problems of Ukraine's water resources need to be solved in the post-war period no less than the issue of the reconstruction of our country, because the contamination of drinking water sources can create a danger to the health of the population in these regions and the threat of the extinction of ecosystems.

References:

1. Mitryasova, O. (2023). Assessment of the state of surface waters within the city of Mykolaiv under wartime conditions, 80-81.
2. Glanz, J., Santora, M., Robles, P., Willis, H., Leatherby, L., Koettl, C., Khavin, D. (2023). Why the Evidence Suggests Russia Blew Up the Kakhovka Dam. The New York Times. Retrieved from <https://www.nytimes.com/interactive/2023/06/16/world/europe/ukraine-kakhovka-dam-collapse.html>

THE IMPACT OF ROBOTICS ON MODERN MILITARY CONFLICTS

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Modern warfare is undergoing a profound transformation, and at the forefront of this shift is the integration of robotics into military operations. Robotics, encompassing a wide range of autonomous and remotely operated systems, is changing the way conflicts are waged and is reshaping the dynamics of the battlefield.

One of the most pressing issues associated with the introduction of robotics into warfare is the deployment of autonomous weapon systems. These systems, equipped with the capability to operate independently, raise critical ethical questions about the use of lethal force without direct human control. For example, Ronald C. Arkin in his work emphasizes the need to address these ethical concerns.

Arkin argues that it is imperative to embed ethical guidelines and mechanisms within the design and behavior of autonomous weapon systems. This approach ensures that such systems adhere to internationally recognized norms and principles, thereby preventing unintended consequences and potential violations of international humanitarian law (Arkin, 2012, p. 149).

Drones, often referred to as Unmanned Aerial Vehicles (UAVs), have emerged as a symbol of the evolving nature of warfare. Their extensive use in various military operations has significantly altered the landscape of conflict. Research conducted by Peter L. Bergen and Katherine Tiedemann provides valuable insights into the widespread use of drones.

Drones have brought about a paradigm shift in military operations. They offer the advantage of precision strikes and real-time surveillance while reducing the risk to military personnel. However, their deployment has sparked considerable debate, primarily concerning their legality, proportionality, and the potential for collateral damage. The ability to conduct targeted operations from remote locations challenges

the conventional rules of engagement and calls for a reevaluation of international laws governing armed conflict (Bergen, Tiedemann, 2013, p.33-40).

The use of robotic systems in maritime operations is another aspect of significance. In his report, Dikmen explores the growing role of unmanned naval systems in enhancing maritime security.

Robotic underwater vehicles and autonomous surface vessels are being employed for various purposes, including mine clearance, reconnaissance, and anti-submarine warfare. These systems have proven to be instrumental in safeguarding maritime routes and gathering critical information. As autonomous systems continue to shape maritime security, new doctrines and strategies are emerging to optimize their use effectively (Dikmen, p.165).

In addition to aerial and maritime robotics, land-based robotic systems are playing an increasingly vital role in modern military conflicts. These systems, including remotely operated ground vehicles, provide a means of executing missions in hazardous and difficult-to-access environments.

Robotic systems designed for ground operations can be used for tasks such as explosive ordnance disposal, surveillance, and reconnaissance. They minimize the risk to human personnel while increasing mission success rates. The development of modular and adaptable ground robots ensures that they can be customized for specific mission requirements, making them versatile tools for military forces.

In the context of the Ukraine-Russia conflict (from 2022), the utilization of robotics in warfare has become increasingly prevalent. Ukraine employs a variety of robotic systems to enhance their military capabilities. Ground-based drones are used for reconnaissance, providing real-time intelligence without risking human lives. UAV groups have been deployed for synchronized attacks and disruption of supply lines. Robotic combat units operate in direct combat roles, particularly in urban warfare scenarios. Autonomous convoy support systems secure supply routes and protect logistics. Remote-operated artillery systems offer precise and devastating firepower. These real-world applications illustrate the significant role that robotics now play in modern military conflicts, providing strategic advantages and

necessitating ongoing ethical and tactical adaptation.

The integration of robotics into modern military conflicts is profoundly reshaping the conduct of warfare. Autonomous weapon systems raise ethical questions, particularly regarding their decision-making capabilities and the potential for misuse. Drones are altering the way wars are fought, raising legal and ethical concerns. In maritime operations, robotic systems enhance the collection of crucial data and improve security, while land-based systems increase mission success rates and reduce risks to personnel.

So, the impact of robotics on modern military conflicts is undeniable, and its implications are far-reaching. It is essential for policymakers, military strategists, and the international community to address the ethical, legal, and strategic challenges posed by the growing role of robotics in warfare. Responsible and ethical use of these technologies is crucial to ensure that they enhance security and contribute positively to global peace, rather than exacerbating the complexities of conflict. As technology continues to advance, the dynamic relationship between robotics and modern military conflicts will continue to evolve, shaping the future of warfare.

References:

1. Arkin, Ronald C. (2013). Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/ Reactive Robot Architecture. University of Massachusetts, Amherst.
2. Bergen, Peter L., and Katherine Tiedemann. (2013). The Year of the Drone: An Analysis of US Drone Strikes in Pakistan, 2004-2013. New America Foundation, Amherst.
3. Mustafa Dikmen. (2016). Role of the Unmanned Aircraft Systems in Maritime Security. Retrieved from https://www.academia.edu/30159335/Role_of_the_Unmanned_Aircraft_Systems_in_Maritime_Security

ENERGY SAVING TECHNOLOGIES

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Nowadays, the question of resource preserving and environmental protection is becoming increasingly urgent. The area of motivation for energy saving is widely used, for example, at industrial enterprises in the UK. UK government agencies also pay great attention to promoting achievements in the field of energy saving, publishing and widely disseminating information about examples of best practice in this area.

Germany has made the greatest contribution to the development of energy-saving technologies; in particular, it is a leader in the field of wind energy, with 20,000 wind generators operating in the country with a total capacity of 24 thousand.

Much attention is paid to solar energy in Germany; it is planned to place 100,000 m² of solar panels on the roofs of administrative buildings only in Berlin. Despite the fact that Germany is a country characterized by rather low rates of active sunny days, on June 9 alone the country generated 23.1 GWh of electricity obtained from solar photovoltaic cells, this amounted to half of the total daily energy consumption of the entire country and was a world record.

Germany abandoned nuclear energy. Part of the nuclear power plants was closed immediately. To reduce energy and resource consumption German's government uses energy and resource saving technologies. For example, powerful energy complexes are used to service industrial, building, and agricultural enterprises. Almost 80% of all energy produced in the country is spent in enterprises (Chochlovski, 2019, p. 15-47).

Enterprises imply the improvement of equipment, the use of high-precision instrumentation. Instrumentation and control equipment is always selected taking into account the specifics of an industrial facility. Thus, for enterprises it is used in the

heat power industries, devices with a high degree of protection from external influences.

Many German enterprises use the following engineering activities:

- using facilities with energy-saving technologies;
- growing productivity in the energy manufacture process;
- introducing projects using alternative energy (such as, wind, water, energy);
- monitoring of consumed resources and launching control systems.

Researches claim that 90% of energy losses are associated precisely with irrational consumption, but only up to 10% is lost during transportation and transmission (Yang, 2023). Therefore, the main directions in energy-saving technologies are related specifically to optimizing the use of heat and electricity.

Germany is the country that most actively uses modern energy saving technologies and alternative energy sources. Today, a third of all electricity here comes from wind turbines. Berlin intends to save on energy through alternative energy sources. All pools will be equipped with solar panels. Private investors will have the opportunity to place more than 100,000 m² of solar panels on the roofs of public buildings and feed the resulting energy into the city grid. Since 2007, the Berlin administration can purchase for its needs only cars that consume no more than 6.5 liters of gasoline per 100 km in the urban cycle. Until 2011, the permissible flow limit should be reduced to 5 liters. When purchasing computers and other electronic devices, Berlin authorities will have to use products that consume the least amount of electricity.

The use of energy and resource-saving technologies makes it possible to reduce the costs of production and operation of equipment, increase its service life, reduce the negative impact on the environment and improve the quality of life of people.

References:

1. Chochlovski, A. (2019). Innovative energy-saving technologies in biotechnological management facilities. Kiev, 15-47.
2. Osborn, A. (1997). Saving energy by raising awareness. *Energy management*. Kiev., 38-49.

Yang, Ch. (2023, October 25). Green site, building and brighter future. Retrieved from

https://digitalpower.huawei.com/en/?utm_medium=cpc&utm_source=corp_google&utm_campaign=web&utm_content=energy%20saving%20innovations

THE DISASTER AT KAKHOVKA HEPP AS ONE OF THE RESULTS OF RUSSIA'S ARMED AGGRESSION AGAINST UKRAINE

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Ukraine is considered the least water-provided country in Europe - only 4% of the country's total area is occupied by reservoirs. Accordingly, the level of water resources in Ukraine is not sufficient (Hohol, 2020, p.1).

Toxic and biogenic substances cause great damage to water resources. For example, nitrate pollution is characteristic of agricultural territories (Nepran, 2021, p.49). But toxic substances are not the only problem.

Water resources suffer from anthropogenic factors, for example, increased use of water resources, disorderly uncontrolled economic activity, siltation and pollution of water bodies. As a result, excessive flowering of water and its shallowing (Hohol, 2020, p.1).

On February 24, 2022, Russia launched a full-scale invasion of the territory of Ukraine. But it would not be Russia if it called a spade a spade, which is why it calls the war of aggression against Ukraine a «special military operation», tries to deny its attack in 2014 and part of the war that lasted 8 years, and justifies the full occupation of Crimea with pseudo-historical factors.

On June 6, 2023, the Russian occupiers committed a crime again – they blew up the dam of the Kakhovka HEPP, despite the fact that the dam is a civilian facility (Romanenko, Nepomniachy, 2023 p.9). Russia again officially denies its crime.

About 700,000 Ukrainians were left without drinking water. The enemy did not

stop shelling even during evacuation and rescue measures. (Romanenko, Nepomniachy, 2023, p.11).

As a result of the world-scale disaster caused by the Russian Federation, the ecosystems below the Dnipro, the Black Sea estuary and the Dnipro estuary were disturbed.

Accordingly, this creates unfavorable conditions for the habitat of not only hydrobionts, the death of terrestrial animals is possible if the land is flooded. It is possible to exterminate entire populations of rodents, as well as animals listed in the Red Book of Ukraine.

In addition to animals, the plant life was also affected - some plants will die due to dehydration, and others due to the inability to adapt to life under water.

The Kakhovka HEPP cannot be restored, so it will create enormous difficulties in water supply for agricultural needs. Also, now it is impossible to control floods and floods (Romanenko, Nepomniachy, 2023, p.11-13).

The lack of quality drinking water and the destruction of housing are not the only threats to humanity. The risks of contracting hepatitis, cholera or contracting an intestinal infection have increased significantly. Because underwater cemeteries, landfills, fields, etc. catalyze the reproduction process of these infections.

An outbreak of anthrax is also predicted, as a section of land was flooded, in which cattle were buried 50-70 years ago, which suffered from this disease ("VisitUKRAINE").

According to NBU estimates, crop losses (cereals and vegetables) and the impact on Ukraine's energy system are moderate (Romanenko, Nepomniachy, 2023, p.15-17). However, this disaster has led to the death of people, animals, ecosystems, can cause outbreaks of dangerous diseases and has made settlements uninhabitable. We should not forget about this ecocide, as well as about other crimes of the Russian occupiers. And we must make every effort to help those who need it and punish the guilty!

References:

1. Hohol, A. (2020). ENVIRONMENTAL PROBLEMS OF WATER RESOURCES IN THE TERRITORY OF UKRAINE. 1.
2. Nepran, I. (2021). ENVIRONMENTAL PROBLEMS OF WATER SOURCES AND THE WAYS OF THEIR SOLUTION. I International Internet-conference "Modern problems of environmental control and audit". 50.
3. Romanenko, Y. Nepomniachy, O. (2023). CONSEQUENCES OF THE DESTRUCTION OF THE KAHOVKA HEPP. MODERN ASPECTS OF VĚDY Svazek XXXV international collective monograph. 11-17.
4. Consequences of blowing up Kakhovska HPP: what diseases threaten Ukraine and the world. (2023, June 13). Retrieved from: <https://visitukraine.today/uk/blog/2042/posledstviya-podryva-kaxovskoi-ges-kakie-bolezni-ugrozayut-ukraine-i-miru>.

INNOVATIVE TECHNOLOGIES IN THE FIELD OF ELECTRICITY SUPPLY

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It has long been no secret that technology is following us everywhere. The 21st century is a time when humanity is developing at a frantic pace, and there are no limits to new discoveries, including power supply technology. Every day we face new challenges that require modern solutions, and it is these challenges that give us the impetus to improve our technologies. So now I will talk about several new technologies.

1. An innovative approach to solving the problems of traction network protection at DC traction substations

Ensuring reliable operation of converter units and protection of electric transport power distribution systems from the destructive effects of emergency

currents depends mainly on the performance of protective devices. In response to the requirements to provide effective solutions that would contribute to the reliable protection of DC electrical circuits in case of short circuits and overloads, as well as to increase the reliability of power supply, Pluto offers an innovative solution - an ultra-fast-acting arc-free DC circuit breaker AFB, which is used in power distribution systems at tram, trolleybus, light rail, and subway traction substations.

The solution is based on the principle of breaking the power circuit in a vacuum. This principle made it possible to eliminate the release of plasma during tripping and to use 2 times less working space compared to circuit breakers with traditional switching and arc suppression. In addition, the absence of a destructive arc significantly reduces the risk of fire. The environmental friendliness and safety of this solution is ensured by the absence of polluting and toxic combustion products, as well as the deposition of combustion products on the circuit breaker elements and switchgear structures.

The AFB circuit breaker provides high-speed opening of power contacts (intrinsic tripping time is < 1 ms) and the ability to trip by the rate of current rise until the short-circuit current trip setpoint is reached.

2. Using artificial intelligence

The specifics of energy supply services, namely the need to process large amounts of information on weather forecasting, energy consumption and production, equipment condition, power lines operation modes, etc. in real time, opens the way for the use of AI in the energy sector. For example, weather forecasting can predict changes in consumer energy needs and, accordingly, better plan the operation of generating facilities to increase the efficiency of existing installations. AI can also stabilize the energy transmission system, for example, by detecting anomalies in production and consumption patterns and developing appropriate solutions to eliminate such anomalies in real time (on-line), connecting/disconnecting energy sources or additional equipment to ensure the stability and reliability of the system (Sukhodolia, 2023).

By increasing the availability of data, AI provides better forecasting of the

operating modes of energy distribution systems. For example, the timing of maintenance in the power grid can be determined by the availability of information on design life, off-design modes, and the level of wear and tear of individual elements, equipment, or materials, which significantly reduces network accidents and costly downtime.

References:

Sukhodolia O. M. (2023). *Shtuchnyi intelekt v enerhetytsi [Artificial intelligence in the energy sector]*. Retrieved from https://niss.gov.ua/sites/default/files/2022-07/dopovid-ai-v-energetici-red_01-pogodzheno-sukhodolya_02-1.pdf

TOV “Pluton IC”. (2023). *Innovatsii [Innovations]*. Retrieved from <https://pluton.ua/innovations>

ROBOTIC INTEGRATION IN OUR LIVES

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Robots as Helpers: Robots are becoming an integral part of our daily lives, seamlessly performing a wide range of tasks, from the simplest to the most complex. They provide invaluable assistance across various domains, including household chores, healthcare, education, and numerous other sectors.

Economic Benefits: The incorporation of robots into various industries can yield substantial economic advantages. Robots are capable of working tirelessly around the clock without fatigue or the need for rest. This non-stop operation significantly boosts overall productivity and output, potentially leading to increased profits for businesses.

Resource Conservation: Robots contribute to the conservation of natural resources due to their efficient use of energy and materials. They are designed to optimize resource consumption, which is especially important in a world where

sustainability and resource management are growing concerns.

Safety and Security: Robots are engineered to operate in hazardous or risky environments where human presence may be dangerous. This enhances overall safety by minimizing human exposure to potentially harmful situations, making it a valuable tool in industries such as manufacturing, construction, and emergency response.

Education and Learning: Robots can serve as effective tools for educational purposes. They offer interactive learning experiences and practical training opportunities. This is particularly beneficial for students and professionals who seek hands-on experience and real-world applications.

Healthcare and Care: Robots play a significant role in the healthcare sector by assisting in the care of patients, especially those who are ill or elderly. They can perform tasks like medication reminders, physical assistance, and monitoring, thereby alleviating the workload of healthcare professionals and providing improved care.

References:

1. World Economic Forum, (2023) Robots as Helpers. Retrieved from: <https://www.weforum.org/agenda/2023/07/robots-ai-help-humans-at-work/>.
2. Infineon Technologies, (2023). Safety in Factories with Robotic Systems. Retrieved from <https://www.infineon.com/cms/en/discoveries/robotics-systems-safety-security/>.
3. SpringerLink, (2021). Robotics in Education: A Smart and Innovative Approach to the Challenges of the 21st Century. Retrieved from https://link.springer.com/chapter/10.1007/978-3-030-77040-2_3

ENERGY SAVING TECHNOLOGIES

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The topic of my work is energy-saving technologies.

And I would like to focus more on technologies that are directly useful to ordinary people, on technologies that have a clear example of practical application in the lives

of ordinary people.

So, I am going to start this list with solar panels. In fact, the technology is very interesting, not only because of its capabilities, but also because of what ordinary people have heard about them, but what it actually is, so a little about this technology. A solar panel is a set of photovoltaic cells connected in parallel and series to achieve a given voltage and current.

Solar panels convert sunlight into energy, bypassing traditional sources of electricity.

Most smart homes rely on solar energy. Gold Coast Solar, think how environmentally friendly this is. Solar energy is renewable, sustainable and inexhaustible. It is clean and does not emit greenhouse gases harmful to the planet - another good reason to include it in the list of energy-saving technologies.

But solar energy is not a panacea, because it is always necessary to remember how solar batteries are arranged, and more precisely, what materials they are made of and where these materials are processed, as you know, in factories that are not currently recognized as safe for the environment.

Next, I would like to talk about household appliances. The largest manufacturers of household appliances offer energy-efficient versions of their products. Energy-efficient dryers use less energy than conventional models without compromising performance and productivity.

This is very important because most of our energy still comes from sources that are not considered environmentally friendly, and we should not. And we should also not forget about the enemy, who constantly conducts crimes by attacking the energy system of our country, so when I spoke about the practical use of energy-saving technologies, first of all, it was necessary to say precisely that these technologies bring our victory closer.

References:

1. Solar about Panel information Retrieved from

<https://greenlivingguy.com/2020/02/10-energy-saving-technologies-for-homes-you-should-consider/>

2. Information about household appliances Obtained from
<https://www.usaid.gov/energy/efficiency/basics/technologies>

RENEWABLES

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Let's first understand what renewable energy sources are. Renewable energy sources are sources that are renewed naturally. Renewable energy sources include periodic or steady flows of energy distributed in nature and limited only by the stability of the Earth as a cosmo planetary element: radiant energy of the Sun, wind, hydropower, natural thermal energy, etc. There are such basic technologies of renewable energy as wind energy, hydropower, solar energy, geothermal energy, biofuel, bioenergy. Now in more detail.

Let's start with wind energy. Wind energy has long been widespread in many countries of the world. Ukraine is no exception, because our country has a significant natural potential for the implementation of wind energy projects. It should be noted that there are seven powerful wind power plants in Ukraine. It should be noted that such wind farms are mainly used in remote areas, because they are ideal for holiday homes, tourist bases and holiday camps.

Next, we will analyze hydropower. Hydropower is one of the oldest areas of energy in general, which is not surprising, because in this case we are talking about obtaining energy from a renewable, almost infinite source. For many centuries, people have used water energy in one way or another, starting with the simplest water mills and ending with modern hydroelectric plants. Compared to other renewable energy devices, hydro generators are the most complex. However, they have an undoubted plus: a hydro generator, equal in power to solar batteries and wind generators, however, produces more energy in the same period of time. Also, hydro generators are durable: their service life is up to 40 years, while the payback period is about 3-5 years.

The most widely used renewable source by ordinary people is solar energy, due to low operating costs - solar installations do not break down, and they are guaranteed for tens of years. It also ensures independence from rising current market prices and commercial suppliers, but reducing electricity costs requires one-time investments.

Geothermal energy is significantly different from other renewable energy sources such as sunlight and wind. More specifically, power plants use steam rising from underground hot water tanks. They are usually at a depth of several kilometers, but due to the high pressure, the water rises to the surface. The advantages of such an energy source are that Geothermal energy will exist until our planet cools down. It is ecological, reliable, but there is limited zoning here. There are quite a few places on the planet where hot water comes out of the ground in sufficient quantities to build power plants. Also, during the processing of hot water, a certain amount of greenhouse gasses is released.

Now about biofuel. Biofuel is an organic fuel obtained from raw materials of vegetable or animal origin, as well as from industrial waste. Varieties: Solid - traditionally, wood processing products (firewood, pressed pellets and briquettes) are a source of energy. Liquid - alcohol mixtures, ethers, biodiesel and biofuels. Gaseous - various gas combinations obtained during the thermal decomposition of raw materials in interaction with pyrolysis (oxygen-free), gasification (oxygen) and during the fermentation process (interaction of bacteria).

And briefly about bioenergy. The production of electricity from biomass at thermal power plants and thermal power plants is the most difficult business in “green” energy from the economic and operational points of view. First: raw materials. In contrast to SES, wind turbines and hydroelectric power stations, which work on the sun, wind and water, a bio-installation requires harvesting, delivery and processing of bio-raw materials. These are additional costs. A 5-6 MW bio-thermal power plant uses about 8,000 cubic meters of forest per month or 10-15 vehicles of raw material per day. Second: exploitation. Compared to other types of RES, bioenergy is the most difficult to operate. But there is also an advantage of such a source - a stable mode of operation. CHP plants based on biomass and biogas operate

in an even load schedule and, unlike solar and wind energy, do not require replacement capacities.

References:

Chukryna, V. (2016, September 14). *Biofuel*. Retrieved from <https://alternative-energy.com.ua/uk/vocabulary/%D0%B1%D1%96%D0%BE%D0%BF%D0%B0%D0%BB%D0%B8%D0%B2%D0%BE/>

Energy front. (2023, October 29). *Renewable energy sources*. Retrieved from <https://efront.in.ua/vidnovlyuvani-dzherela-energiyi-vde/>

Voitova, V. (2021, January 08). *Wind energy: advantages and disadvantages*. Retrieved from <https://vinnytsia.name/uk/articles/2108-energiya-vitru-perevagi-i-nedoliki>

IMPROVING THE DESIGN OF ELECTRIC ARC FURNACE MECHANISMS

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An electric arc furnace is a machine that is necessary for the production of steel. The reasons for the development of steel production in electric arc furnaces: the great need for high-quality steel and the need to obtain this steel from ore.

Electric arc furnace designs are constantly changing for three reasons: changes in steel production technology, improved technological progress, and changes in electric arc furnace sizes.

The design of the electric arc furnace consists of: a steel body; Inside the steel body there is thermal insulation made of two types of refractory bricks: the main one – magnesite and the auxiliary one – dinas. The bottom of the housing is limited by a fireproof floor, and the top of the housing is limited by a vault with holes for electrodes. In the walls of the housing there are: a window for releasing slag and a window with a chute for releasing steel. There are mechanisms around the body: a

mechanism for moving the furnace, a mechanism for moving the electrodes, a mechanism for lifting and turning the arch and a tilt mechanism.

The most important mechanism of an electric arc furnace is the tilting mechanism. It is needed for draining metal and slag. The tilting mechanism must tilt the electric arc furnace smoothly and accurately at different speeds and must support the weight of the furnace and metal. To drain metal, the furnace tilts from 40 to 45 degrees forward, and to download slag, the furnace tilts from 10 to 15 degrees to the other side (Musskiy, 2023).

References:

1. Karbowniczek, M. (2021). Electric arc furnace steelmaking. CRC Press.
2. Musskiy, S. (2023). Electric arc furnace. History of invention and production. Retrieved from <https://uk.diagram.com.ua/info/engineering-and-technology/engineering-and-technology002.shtml>.

WATER RESOURCES OF UKRAINE: ENVIRONMENTAL CHALLENGES AND THE DISASTER OF THE KAKHOVKA HYDROELECTRIC PLANT

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Water resources in Ukraine play a key role in the country's economy and life. Unfortunately, however, these resources face numerous environmental challenges that affect the natural environment, social sphere and economy. One of the main problems is the construction and destruction of hydroelectric power plants, in particular the Kakhovka HPP.

The Kakhovka reservoir is one of the largest reservoirs in the Dnipro River cascade system. The idea to build the reservoir originated in Soviet times, in the 1930s, and was intended to create a powerful reservoir for irrigation of agricultural land and regulation of river waters in Ukraine. Construction of the reservoir began in 1950 and lasted several years (Lebid, 2023).

The Kakhovka HPP was designed to generate electricity and provide drinking water to the southeastern part of Ukraine. It also provided navigation on the Dnipro River. However, along with the positive aspects, there were also negative aspects.

However, in addition to the positive aspects of the construction of the hydroelectric power plant, we cannot ignore its negative aspects. If we analyse the impact of this construction on nature, it is worth noting that huge areas were flooded and ecological systems were lost. Numerous ecosystems were negatively affected and destroyed. The social consequences are also worth noting. For example, thousands of residents from 90 villages had to leave their homes forever. People took their property and livestock. Resettlement to 1,063 specially built houses was voluntary and compulsory. Agricultural land that was flooded could no longer be used for agriculture, leading to loss of production and reduced availability of agricultural products on the market. This affected the food security and economic development of the region (Kakhovka Dam).

On 24 February 2022, the power plant was seized by Russian troops and has been controlled by the occupation forces ever since. However, at dawn on 6 June 2023, it became known that the dam of the Kakhovka HPP had been partially destroyed, leading to catastrophic consequences.

The Ministry of Agrarian Policy and Food of Ukraine reported that approximately 10,000 hectares of agricultural land on the right bank of the Dnipro River were at risk of flooding, and that the number could be several times higher on the left bank. The dam's destruction has had a significant impact on the region's ecology and has caused damage to plants and animals. The situation has also become critical for irrigation systems in different regions of Ukraine (Significant damage to the agriculture of Ukraine was caused by the destruction of the Kakhovska hydro electric station by the russians, 2023).

This disaster underscores the importance of preserving and planning for the sustainability of water infrastructure and the natural environment in line with overall strategies and measures to minimise the potential impact of conflicts and natural disasters. The development of alternative energy sources and efficient energy-saving

technologies is a key element in reducing pressure on water resources and maintaining ecological balance in the region.

Thus, the environmental problems of water resources in Ukraine require serious attention and solutions, as well as the search for sustainable development and preservation of the country's natural resources.

References:

1. Лебідь, Н. (б. д.). Каховська ГЕС: історія та трагедія споруди. Центр політичного консалтингу. Retrieved from <https://cpc.com.ua/articles/kakhovska-ges-istoriya-ta-tragediya-sporudi>
2. Каховська ГЕС. (б. д.-а). (2008). Retrieved from https://ru.wikipedia.org/wiki/%D0%9A%D0%B0%D1%85%D0%BE%D0%B2%D1%81%D0%BA%D0%B0%D1%8F_%D0%93%D0%AD%D0%A1%D0%AD%D0%BA%D0%BE%D0%BD%D0%BE%D0%BC%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%BE%D0%B5_%D0%B7%D0%BD%D0%B0%D1%87%D0%B5%D0%BD%D0%B8%D0%B5
3. Знищення росіянами Каховської ГЕС завдало значних збитків сільському господарству України. Міністерство аграрної політики та продовольства України. - Електронний ресурс. (б. д.). (2023). Retrieved from <https://minagro.gov.ua/en/news/significant-damage-agriculture-ukraine-was-caused-destruction-kakhovska-hydro-electric-station-russians>

ENERGY SAVING TECHNOLOGIES

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Mankind, having gone through a difficult path of development of technologies for obtaining heat, has created high-tech equipment, which, it would seem, is difficult to further improve. And as paradoxical as it sounds, it returned to the so-called "non-traditional sources" - sun, wind, water. Technologies for obtaining heat from these

sources have also changed. Humanity has learned to use other resources, such as soil, air, and underground water. Today, environmental friendliness has become the main criterion for product quality all over the world. And this requires not only the use of equipment, but also the process of its production. Legislation and policies of many countries, especially European ones, promote the spread of alternative sources, which essentially affects their spread. The leaders in this matter are Sweden, France, Austria, Spain and Germany. Smart people learn from other people's mistakes and experience, so let's get world experience and not repeat the difficult path of development that the whole world has gone through and everything to reverse traditionality. The truth says: "Everything new is a well-forgotten old."

The main direction of world energy development is the use of alternative energy sources, such as the sun, wind, water and biofuels. The use of waste from the agro-industrial complex, pellets, and conversion of gas boilers is also relevant for Ukraine.

Scientists are constantly looking for new opportunities to increase efficiency and use more available materials for renewable energy sources. For example, recently, Chinese scientists have increased the efficiency of organic solar cells, comparing them with conventional ones. Modules made of carbon and plastic have been found to be cheaper than conventional silicon ones, and thanks to their structure, they can be applied to thin and flexible surfaces such as windows, facades, columns, trees.

But don't forget that cheap and clean energy is important, but energy efficiency inside the building is just as important. According to recent research from the University of Michigan, 74% of the total energy consumption of commercial buildings comes from lighting, heating, air conditioning and ventilation systems, as well as water supply. What technologies can be used to reduce these costs?

Let's start with heating. Experts say that the most heat is lost through windows and walls, so insulating facades and replacing windows with energy-efficient ones are mandatory for any commercial building. The next step may be to modernize the heating system. Modern technologies make it impossible to modernize existing boilers and switch from gas to organic fuel.

A reduction in lighting costs can be achieved by the installation of lighting and

sensors, movement and maximum use of daylight. Thanks to the use of various sensors, you can automatically adjust the brightness of the lighting, turn off the light when people leave the room. In some cases, this can save you another 20%.

Regarding air conditioning and ventilation, the most advanced method of reducing costs is an installed heat recovery system. Proper setup and maintenance can reduce costs by up to 10%.

Water saving technologies include the collection and further processing of rainwater for further use in the building. Of course, it is relevant only in latitudes where it rains quite often, and in winter there is no sub-zero temperature. For most developed countries, automated water supply sensors and the use of the residual potential of coolants for water heating are relevant.

All these methods and technologies can be added separately or in combination. An individual approach, a preliminary study of construction and infrastructure features, conducting an energy audit to determine the most expensive sectors are important. In difficult economic conditions, the complete re-equipment of buildings with energy-efficient solutions can be difficult to achieve, but with a developed plan, the gradual reduction of costs can have a positive effect on the cost of products and work productivity.

References:

1. Energy-saving technologies. (2004). Retrieved from <https://ukrreferat.com/chapters/rps/energozberigayuchi-tehnologii-referat.html>
2. Energy-saving technologies. We understand, we analyze. (2019). Retrieved from <https://shen.ua/obzor-i-analitika-otrasli/energoberegajushie-tehnologii-razbiraemsja-analiziruem/>

ENERGY SAVING TECHNOLOGIES

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Energy-saving technologies are a method of manufacturing products with rational use of energy. Use of energy, which allows to reduce the amount of energy waste generated in the production of products.

Energy-saving technologies are relevant not only in highly developed countries, but also in a country at war, as the destruction of businesses and production forces them to look for alternative sources and quick ideas that will influence further development.

The main types of energy-saving measures are as follows:

1) organisational measures - quick-impact measures – internal energy audits, preparation of an enterprise's energy passport, development of energy saving measures and improvement of technological processes efficiency, monitoring of the implementation of the measures taken to stimulate and motivate energy-saving behaviour, the introduction of the right to dispose of funds from energy-savings.

2) technological measures – basic measures – are more radical and facilitate the rapid implementation of cost-effective and financially attractive investments.

3) investment measures - high-cost and high-efficiency measures help to eliminate the main causes of low energy efficiency, in most cases guaranteeing more significant energy savings, but require higher initial costs.

If we take the energy sector as a whole, we can see that many new and interesting companies are opening in Ukraine during the war, which are already automating the production and installation of modular equipment, as well as the use of new technologies for the construction of movable walls called “sandwich panels”, which help to quickly assemble partitions and load-bearing walls.

And some words about saving energy in the household.

Modern energy-saving technologies for residential buildings are becoming more and more popular. The easiest option for an audit is the use of a thermal imager - the results show the main causes of heat loss.

For a more rational use of thermal energy, we can take the following measures:

1) Wall insulation. This measure can greatly reduce your financial losses on

heating in the winter. And in the summer, our house stays cool.

2) Making our heating system more efficient. You can try:

1) insulation of pipes of heating systems;

2) Installation the screen behind the radiator;

3) If your radiators are too old - you should install new, because old radiators heat transfer is too bad.

3) Recuperation of heat. Recuperation is reusing of heat and moisture from air from our home. Recuperators get heat from air from home and give it to fresh air from the outside. As a result, living building is warm in winter and cooling in summer.

4) Using of solar collectors. This thing uses power of visible and infrared rays of solar radiation. This way can provide us with hot water during all year. And you can use it as part of a heating system.

For more rational use of electric energy in the household is necessary to use high-efficient instruments (with A+++, A++, A+, A, and, at least B efficiency class). And, for efficient use of those instruments is necessary to follow regulations of using and make full service in time.

All these measures don't give results instantly and require investment. It must pay off in several years and in the future, you can economize your money without discomfort.

References:

1. Pro zatverdzhennia derzhavnoi tsil'ovoi ekonomichnoi prohramy enerhoefektyvnosti i rozvytku sfery vyrobnytstva enerhonosiiv z vidnovliuvanykh dzherel enerhii ta al'ternatyvnykh vydiv palyva na 2010-2016 roky. (2010). Retrieved from: <http://zakon2.rada.gov.ua/laws/show/243-2010-%D0%BF>

2. Afonchenkova, T. (2008). Formuvannia ekonomichnoho mekhanizmu enerhozberezhennia sil's'kohospodars'kymy pidpriemstvamy. Ph.D. Thesis, European University, Kyiv, Ukraine

3. Saving energy in household – energy-saving technologies for house. (2019). Retrieved from: <https://eenergy.com.ua/energoefektyvnist/energozberezhennya-v->

pobuti-energozberigayuchi-tehnologiyi-dlya-domu/

4. Specialities and advantages of outside wall insulation. Retrieved from:

<https://termopaneli.net/osobennosti-i-preimushhestva-vneshnego-utepleniya-doma/>

5. What is recuperator and recuperation of heat? (2021. June 15). Retrieved from:

<https://recuperator.com.ua/uk/blog/dumky-ekspertiv/shcho-take-rekuperator-ta-re>

5. Solar collector. (2023, February 6) Retrieved from:

<https://uk.wikipedia.org/wiki/>

PROSPECTS OF ARTIFICIAL INTELLIGENCE

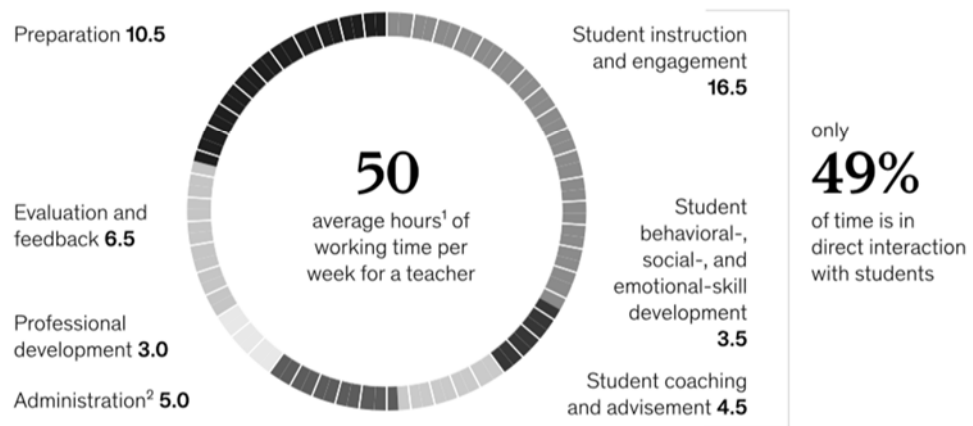
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AI in teaching process: As lots of people know, AI is very good at school subjects, showing great results on final tests and these results become better and better from one model to another. Having these knowledges, it's obvious to try this technology in the teaching and studying process. The main tasks, the teacher can do with existing AI-s are about administration, science, the teachers from Canada, Singapore, UK and the US often cite unmanageable administrative tasks as their greatest source of exhaustion and burnout. By automating boring, but repeatable tasks, teacher can have more spare time to build connections with students, give more precise feedback etc. It's also important to remember, that teachers can use AI to search for information related to the subject, doing it during lessons or during preparation and, in the second case, more time to communicate with students will free. Trevor J. (2023, October 22). Missed Out on Nvidia? 1 Artificial Intelligence (AI) Stock Could Be the "Fastest-Growing Software Company," According to This Wall Street Analyst. *MSN*.

Teachers work about 50 hours a week, spending less than half of the time in direct interaction with students.

Activity composition of teacher working hours, number of hours



AI in studying process: AI can be a valuable tool for students who are learning by themselves. It can help with understanding information (by giving examples and creating parallels), research by providing personalized learning experiences, replaying previously learned information, analyzing large amounts of data to do more precise research, and automating repetitive tasks, such as: creating studying flashcards, creating or searching for questions to check student's knowledges, visualization. Chincholi, A. (2022, September 20). How AI Is Changing the Way Students Learn. *Forbes*.

AI will transform the scientific method: With the power of artificial intelligence and machine learning, we can anticipate remarkable advancements in what can be achieved. AI provides an unparalleled capacity to scrutinize vast datasets and uncover intricate connections and patterns through computation. As it enhances human intelligence, AI is poised to revolutionize the process of scientific research, ushering in an exciting era of scientific breakthroughs in the near future. Tewari, G. (2022, May 5). The Future Of AI: 5 Things to Expect in The Next 10 Years. *Forbes*.

AI-driven automation will change the work market: The work market will change as a result of AI-driven automation, necessitating new positions and skills. Industries like transportation, agriculture, and retail will witness the integration of AI-driven automation, leading to increased efficiency and productivity. Moreover, more people will be free from repeatable work, which will lead to more creative and

efficient time spending on their jobs. Mallu, M. (2023, May 16). Future prospects for AI in 2023. LinkedIn.

AI is a potential phenomenon, that is able to drastically change the healthcare industry by enabling faster and more accurate diagnosis, personalized treatment, and efficient drug discovery. AI can play a significant role in shaping the future of healthcare by providing better data-driven decision-making to improve the healthcare system, better patient outcomes, and cost and energy savings. AI can also assist in tackling some of the crucial issues in healthcare, such as the shortage of healthcare staff and the imbalance of medical resources. AI can be used in clinical and non-clinical interventions, starting from clinical research, patient engagement to drug development and delivery. AI can also be used in medical imaging, surgical decision-making, and deep learning in radiology. However, there are specific challenges of ethics and privacy that need to be addressed. The demand for huge datasets incentivizes developers to acquire data from a large number of patients, which may infringe on their confidentiality. Rastogi, M. (2023, June 1). THE GROWTH AND POTENTIAL OF AI APPLICATIONS IN MEDICINE AND HEALTHCARE. Indian Journal of Applied Research.

In summation, the integration of AI into education, research, industries, and healthcare is ushering in an era of unprecedented possibilities. As it continues to evolve, it promises to enrich the human experience, enhance productivity, and contribute significantly to advancements across various sectors, all while raising important ethical questions that require careful consideration.

References:

1. Chincholi, A. (2022, September 20). How AI Is Changing The Way Students Learn. *Forbes*. Retrieved from <https://www.forbes.com/sites/forbestechcouncil/2022/09/20/how-ai-is-changing-the-way-students-learn/?sh=14fe46ea7338>
2. Trevor J. (2023, October 22). Missed Out on Nvidia? 1 Artificial Intelligence (AI) Stock Could Be the "Fastest-Growing Software Company," According to This Wall Street Analyst. *MSN*. Retrieved from

<https://www.msn.com/en-us/money/companies/missed-out-on-nvidia-1-artificial-intelligence-ai-stock-could-be-the-fastest-growing-software-company-according-to-this-wall-street-analyst/ar-AA1iElci>

3. Tewari, G. (2022, May 5). The Future Of AI: 5 Things To Expect In The Next 10 Years. Forbes. Retrieved from <https://www.forbes.com/sites/forbesbusinesscouncil/2022/05/05/the-future-of-ai-5-things-to-expect-in-the-next-10-years/?sh=3633185b7422>

4. Mallu, M. (2023, May 16). Future prospects for AI in 2023. LinkedIn. Retrieved from <https://www.linkedin.com/pulse/future-prospects-ai-2023-mallik-mallu/>

5. Rastogi, M. (2023, June 1). THE GROWTH AND POTENTIAL OF AI APPLICATIONS IN MEDICINE AND HEALTHCARE. Indian Journal Of Applied Research. Retrived from <https://www.semanticscholar.org/paper/THE-GROWTH-AND-POTENTIAL-OF-AI-APPLICATIONS-IN-AND-Rastogi/651428efef2ca11f2577c9bc332e2241ec5a93e5>

TACKLING THE ISSUE OF WASTE CRISIS

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The issue of managing waste came on a global level. Annually, 2.12 billion tons of waste is produced across the world. A lot of garbage is disposed of illegally and oceans are filled with plastic waste. Worldwide the main waste management method involves burial in landfills. It's not rational to simply put all of the waste in the landfills, considering the long decomposition time, without sorting and recycling the amount of garbage is going to take up more and more space (Table 1).

Household waste:	Biodegradation time:
Food waste	5 days – 1 month
Paper	2 - 5 months

Car tires	2000 years
Plastic bottle	500 years
Glass bottle	1000000 years
Aluminum can	100 years
Nylon shirt	30 - 40 years
Painted wood	13 years

Table 1.

When buried under the ground and with anaerobic conditions (without access to oxygen) waste begins to biodegrade which leads to the formation of bacterial fungal infection with toxic gases such as methane (CH₄) and carbon dioxide (CO₂) (Mazur, 2022, p. 65). These types of gases lead to the greenhouse effect and pollute the environment.

In Ukraine waste management is a big problem, the lack of recycling stations leads to ecological catastrophe. A lot of garbage isn't being stored properly, being burned or thrown away into water sites. According to various estimates, there are over 30 000 illegal (uncontrolled) landfills, which is approximately 7% of the entire area of Ukraine.

However, household waste makes up only 5% of all waste, they carry greater danger for people and the environment. To solve this issue government and private enterprises should be interested in managing waste. To reduce the amount of garbage that comes to landfill it primarily should be sorted, and then either recycled or correctly disposed. Each type of trash should be divided into groups, and depending on that group there must be methods of taking care of it. The more financial resources are allocated to waste management the more different groups and methods can be used.

Components of household waste:	%
Food waste	35-50
Paper	10-15
Polymers	9-13
Glass	8-10

Metals	2
Textile	4-6
Wood	1
Construction waste	5
Other waste	10

Table 2.

Food waste makes up almost 50% of all the waste in Ukrainian landfills (Table 2). Organic waste can be put in a separate dumpster, sorted from other waste, and then taken to special areas for biodegradation. When decomposing waste needs additional oxygen supply to prevent the formation of greenhouse gases. Compost received due to this process can be used in agriculture, or sold to residents or industries for profit. To make the fertilization process more effective the waste can be additionally ground, and microorganisms can be artificially added.

Paper, glass, and metals can be collected, processed, and recycled into a raw material which can be then used for manufacturing new products. Polymers take a long time to biodegrade and they are difficult to reuse. But they can be recycled both mechanically and chemically. Plastic and rubber can be chopped, sorted by size and color, and then used in the production of something else. For example, rubber mulch is used for landscaping and playgrounds. Plastic can be incinerated with energy recovery, and rubber can be turned into fuel by pyrolysis.

The issue of waste can be managed in Ukraine and even globally. To make that happen government must fund and create favorable conditions for waste management businesses or solve the problem itself. Many enterprises worldwide have shown that it's possible to make money from garbage. People should understand and be taught about proper garbage disposal, as we are the only ones who can control our actions.

References:

1. Mazur, K. V., & Gontaruk, Y. V. (2022). Prospects for biogas production from waste of enterprises and households on solid waste landfills. Eastern Europe: economy, business and management, 65–66.
<https://doi.org/https://doi.org/10.32782/easterneurope.35-9>

2. Baitsar, R. I., & Depko, K. I. (2009). Regulatory and legal provision of the sphere of management solid domestic waste, 206-207.
<https://vlp.com.ua/files/32.pdf>
3. How Much Do We Waste? A Data-Driven Guide to Waste and Landfills. (2022, July 26). MeuResíduo. Retrieved from <https://www.meuresiduo.com/blog-en/how-much-do-we-waste-a-data-driven-guide-to-waste-and-landfills/>
4. How Long Does It Take for Common Materials to Decompose? (2022, August 15). Recycle Track Systems. Retrieved from <https://www.rts.com/blog/how-long-does-it-take-for-common-materials-to-decompose/>
5. Landfills and their impact on the environment. (2020, January 30). Reline waste and recycling solutions. Retrieved from <https://www.reline.com.ua/statti/smittezvalyshha-ta-dovkilliya/>

ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Ukraine, like many other countries, faces various ecological challenges related to its water resources.

Water Pollution: Industrial activities, agricultural run-offs, and improper disposal of waste often lead to the pollution of water bodies in Ukraine. This pollution not only affects the quality of water but also poses a threat to aquatic life and public health.

Deteriorating Water Quality: The quality of water in rivers and lakes is continuously degrading due to the discharge of untreated or partially treated sewage and industrial effluents. This affects the availability of clean water for consumption and agricultural purposes.

Groundwater Depletion: Excessive use of water for agriculture, industry, and

domestic purposes has led to a depletion of groundwater resources in various regions of Ukraine. This has significant implications for agriculture and the overall sustainability of water resources in the country.

Inefficient Water Management: Inadequate infrastructure and inefficient water management practices contribute to the mismanagement of water resources. This results in the unequal distribution of water, particularly during droughts and floods, leading to challenges in maintaining a balance between various water uses.

Lack of Water Conservation Measures: The absence of effective water conservation measures and awareness programs often results in the wastage of water in various sectors, exacerbating the water scarcity problem and putting additional pressure on available water resources.

Eutrophication: Run-off from agricultural fields and the discharge of untreated sewage contribute to eutrophication, leading to excessive growth of algae and other aquatic plants, which can deplete oxygen levels in water bodies and harm aquatic ecosystems.

Transboundary Water Issues: Ukraine shares its water resources with neighboring countries, and the management of transboundary rivers and water bodies often leads to disputes and challenges in maintaining a sustainable and equitable distribution of water resources.

Addressing these ecological problems requires the implementation of effective water management policies, the adoption of sustainable agricultural practices, the improvement of wastewater treatment facilities, the promotion of water conservation measures, and the enforcement of regulations to prevent water pollution. Additionally, international cooperation and collaboration with neighboring countries are essential for effectively managing transboundary water resources.

Support for environmentally friendly technologies: Encouraging the introduction of environmentally friendly technologies in industry and agriculture can help reduce water pollution.

Efficient use of irrigation: Improving irrigation systems and increasing the efficiency of water use in agriculture can help reduce water consumption.

Development of renewable sources of water supply: Involving renewable sources of water supply such as rainwater and underground sources can help in reducing the stress on surface water sources.

Promoting public education and awareness: Raising public awareness of the importance of water conservation and the impact of human activities on aquatic ecosystems can lead to changes in consumption habits and reductions in water pollution.

So, the development of effective systems for monitoring water quality and controlling the use of water resources can help to identify problems in time and avoid further deterioration of water quality. These measures, combined with effective policies and regulations, can help Ukraine overcome environmental water resource challenges and ensure the sustainable use of valuable aquatic ecosystems for future generations.

References:

1. Philpott, B. (2019). War time damage at two London reservoirs. *Dams and Reservoirs*, 29 (4), 133–138. Retrieved from: <https://doi.org/10.1680/jdare.19.00010>
2. Gascon, A. (2015). Battles on the Nile: A war for water? *Bulletin de l'Association de géographes français*, 92 (2), 154–166. Retrieved from: <https://doi.org/10.4000/bagf.565>
3. Hasan, M., Moody, A., Benninger, L., Hedlund, H. (2018). How war, drought, and dam management impact water supply in the Tigris and Euphrates Rivers. *Ambio*, 48 (3), 264–279. Retrieved from: <https://doi.org/10.1007/s13280-018-1073-4>
4. Osadcha, N., Nabyvanets, Y., Osadchyi, V., U Khan, O., Osypov, V., Luzovitska, Y. et al. (2021). Pressures and impact analysis in the Dnipro River basin within Ukraine. EGU General Assembly 2021. Retrieved from: <https://doi.org/10.5194/egusphere-egu21-6493>

GLOBAL WARMING

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Global warming is a term referring to the impact of human actions on the climate, for example, the burning of fossil fuels (coal, oil, and gas) and deforestation, which leads to the emission of a large amount of 'greenhouse gases' into the atmosphere, of which carbon dioxide is the most important.

Global warming will cause large-scale climate change that will adversely affect human communities.

The greenhouse process is a natural process that maintains the Earth's temperature at levels conducive to life. However, over the past century and a half, the concentration of greenhouse gases in the atmosphere has increased significantly. Currently, this concentration exceeds the historical level by more than a third.

The greenhouse effect leads to the warming of the Earth's surface, oceans and lower atmospheric layers due to specific gases that are present in the air. These gases allow solar radiation to enter the lower atmosphere but prevent it from escaping into space, creating a metaphorical blanket of the Earth.

The United Nations organization has made the following conclusions referring to the concentrations of greenhouse gases and rising temperature:

- The concentration of greenhouse gases in the Earth's atmosphere is connected to the average temperature on Earth.
- The concentration and temperatures have been rising consistently since the time of the Industrial Revolution.
- About two-thirds of greenhouse gases are carbon dioxide (CO₂). It is produced by burning fossil fuels.

For many years our climate has been in a condition of balance with a concentration of CO₂ of about 280 ppm in parts per million, which is connected with the proportion of amount molecules of carbon dioxide in the atmosphere to the

number of molecules of all the gases in the atmosphere.

The various fields that generate carbon dioxide, as a result of human activity are given in Table 1.

Table 1. Worldwide sources of carbon dioxide emissions, 2018.

	Carbon dioxide emissions, %
Electricity	27
Transport	28
Industrial (including cement manufacture)	22
Residential (heating, wood fires)	12
Agriculture other	11

According to independent analyses by NASA and the National Oceanic and Atmospheric Administration (NOAA), Earth's average global surface temperature in 2019 was the second warmest since modern record-keeping began in 1880 (Letcher, 2021).

For the necessary reduction of carbon dioxide emissions, there is such an opportunity: sequestration of carbon dioxide resulting from burning fossil fuels, rather than releasing it into the atmosphere, to become much more efficient in generating and using energy, as well as providing energy supply from non-fossil fuel sources.

References:

1. Letcher, T. M. (2021). Global warming – a complex situation. In Elsevier eBooks (pp. 3–17). Retrieved from <https://doi.org/10.1016/b978-0-12-821575-3.00001-3>
2. Houghton, J. T. (2005). Global warming. Reports on Progress in Physics, 68(6), 1343–1403. Retrieved from <https://doi.org/10.1088/0034-4885/68/6/r02>

TECHNOLOGICAL BREAKTHROUGHS OF PARAMOUNT IMPORTANCE NOWADAYS

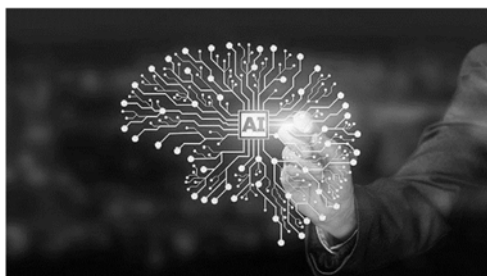
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Can you imagine yourself flying in a car over your city in a few years? How often do you use artificial intelligence (AI)? These are just two examples of technological breakthroughs, which, in our opinion, have a great influence on the development of mankind.

AI is probably the most crucial technological breakthrough of the modern world. Most AIs developed to date is “weak” or “narrow”. So, for example, artificial intelligence can beat the world's best chess player, but if you ask it how to write a letter or fix a chair, it won't be able to do it. This is developing rapidly: AI can learn to multitask, opening the possibility of "artificial general intelligence" in the future.



An artificial general intelligence (AGI) would be AI with the most similar malleability of thinking as a human – and perhaps consciousness too – as well as the superhuman abilities of a digital intellect. Some corporations engaged in the development of AI have made it their aim to create AGI. One such company claims it will “enhance humanity by increasing abundance, energizing the global economy and supporting the discovery of new scientific knowledge” and become “a tool that multiplies the immense power of human ingenuity and creativity” (Fisher, 2023).

Regarding the already existing advantages of AI, we can name the following:

- Reduction in human error: AI can increase accuracy and precision and reduce errors;
- New inventions: in almost every area of activity, AI is the driving force behind countless innovations that will help humanity in resolving the majority of complicated issues;

- 24x7 Availability: artificial intelligence can perform tasks endlessly without any interruptions. It thinks more rapid than humans and perform various assignments at a time with perfect results.

However, a part of a humanity is scared about going a step further – creating AI that is much smarter than people – could bring serious hazards. There are also the following disadvantages of AI:

- High costs: being able to invent a machine that can imitate human intelligence is a significant achievement.
- No creativity: a major drawback of artificial intelligence is that it cannot learn to come up with new ideas.
- Make people lazy: AI applications automate the lion's share of monotonous and repetitious assignments. Since we do not have to remember things or solve puzzles to get some tasks done, we tend to diminish using our brains.

The future and its inventions seem distant to us, but it is not. This also applies to dreams about flying cars. Anyone who has the financial means can even now pre-order such a device, the production of which is planned for 2025-2026.

The need to create such machines is explained by its advantages. The introduction of flying machines will be able to solve the issue of time loss and heavy traffic on the roads. In addition, this invention will help with some environmental problems, such as the carbon footprint. This can be explained by the fact that with the appearance of such electric cars, the number of ordinary cars will decrease.



What separates us from using them here and now? The main problems are noise pollution and lack of appropriate infrastructure. According to the inventors themselves, solving these problems is currently impossible, since the necessary devices for this have not yet been invented.

Technological progress does not stand still. Things that seemed impossible before have become commonplace. Things that seem unreal now will soon appear in

our daily lives. Therefore, our goal is to make technological breakthroughs that will improve human life, and not devalue people and human work.

References:

1. Fisher, R. (2023, July 20). The A-Z of AI: 30 terms you need to understand artificial intelligence. BBC Future. Retrieved from: <https://www.bbc.com/future/article/20230717-what-you-should-know-about-artificial-intelligence-from-a-z>
2. Duggal, N. (2023, October 11). Advantages and disadvantages of artificial intelligence [AI]. Retrieved from: [Simplilearn.com. https://www.simplilearn.com/advantages-and-disadvantages-of-artificial-intelligence-article](https://www.simplilearn.com/advantages-and-disadvantages-of-artificial-intelligence-article)
3. Bernhard, A. (2023, July 20). What's standing in the way of the flying car? BBC Future. Retrieved from: <https://www.bbc.com/future/article/20230714-whats-standing-in-the-way-of-the-flying-car#:~:text=A%20new%20era%20of%20flight,for%20exhibition%2C%20research%20and%20development>

THE CONTRIBUTION OF UKRAINIAN SCIENTISTS AND ENGINEERS TO SPACE RESEARCH

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Currently, the issue of prospects for the development of the space industry in Ukraine is relevant. After all, the space industry occupies one of the priority places in the economy of our country. Achievements in this field provide our country with a leading position in the international market of space technologies. It should be noted that Ukraine belongs to the space states of the planet. Ukraine and Ukrainians played a major role in the development of cosmonautics. Ukrainian scientists and designers have theoretical achievements, they are known in the world for the results of practical

tests of their developments. Ukraine has the capabilities to design and launch space rockets and devices into Earth orbit. Information, data of Earth research, which is obtained with their help, is necessary for the successful development of various branches of the modern economy.

Among the notable achievements of Ukrainian specialists in the space industry are the creation of the Sich-1, Okean-O, AUOS and Micron spacecraft, the Zenit-3SL, Dnipro, and Cyclone-3 rocket carriers (Gluschenko, 2016). Ukraine participates in international projects to create the Antares and VEGA launch vehicles.

Ukraine, as a real space state, has a significant number of outstanding creators and theoreticians of cosmonautics. Among them is Serhiy Pavlovych Korolev. He is a Ukrainian scientist known for his achievements in the field of rocketry and cosmonautics. He is the chief designer of the world's first rocket and space systems. Konstantin Tsiolkovsky is considered the founder of modern cosmonautics. He was a descendant of the family of Hetman Severyn Nalivaik from Volyn. He was the first to scientifically substantiate the hypothesis of interplanetary travel. K. Tsiolkovsky is one of the founders of rocket engineering and modern cosmonautics. Academician Mykhailo Yangel is the main developer of several generations of strategic combat missiles. Leonid Kadeniuk is the first cosmonaut of independent Ukraine. He flew on November 19 as part of the international crew on the American spaceship "Columbia".

So, Ukrainian scientists, engineers, designers made a great contribution to the development of the space industry. Recently, the domestic space industry has turned to international cooperation for the implementation of future programs and projects.

References:

1. Fedorov, O. (2018). Pro novu filosofiiu kosmichnyh doslidzhen. *Den*. 185-186. Retrieved from <https://day.kyiv.ua/uk/article/cuspilstvo/pro-novu-filosofiyu-kosmichnyh-doslidzhen>
2. Gluschenko, N. (2016). Top-10 Space Achievements of Independent Ukraine. *Euromaidn press*. Retrieved from

FROM SPEAKING STATUES TO FAMILY PETS – ROBOTIC INTEGRATION IN OUR LIVES

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We all know what is a robot.

But what do we know about their history? Just as science has a protoscience that arose millennia ago, so robots have their ancient prototypes. They are called “automatons”.

Robots are mostly powered by electricity and are always electric. While variety of sources are suitable for an automaton, which can also be either mechanical or electrical in nature. (1)

We can say, that mechanical figures capable of performing certain actions, repeating the movements of creatures or objects from everyday life, are called automatons. Some sources say, that they can rightfully be considered the first robots in history (2)

It's believed that those “ancient prototypes” were found in Greece. For example, an Archytas' “Pigeon”. There was also created the first alarm clock. (3)

According to French Egyptologist Gaston Maspero (1846–1916) (4), the Egyptians had “speaking statues”. They were made of painted or gilded wood with jointed limbs and voices operated by temple priests. From them you could had an answer for your question. There was another well-known statue in the temple of Amun in Thebes. There is a belief that it used to raise its arm and select the next pharaoh from among male members of the royal family.

In 3rd century BC Lie Zi described in his book a singing and dancing robot that performed for King Mu of Zhou.

The 15th century was marked by the creation of the first humanoid robot –

knight - by Leonardo Da Vinci. (5)

If generalize, we can see that during its existence, the creation of the automaton was motivated by some rituals, practical benefit or simply for fun.

The 17th century in a history of automation is remembered for Japanese Karakuri puppets, built for entertainment. (6)

And then comes 18th century with Canard Digérateur, or Digesting Duck (7) Even though, this “bird” was pretty popular at that time.

So now, having formed a minimal impression of its predecessors, we can say a few words about how the robot itself was formed, and about the presentation we are used to.

The earliest robot was created by George Devol back in 1950s. He invented and patented a reprogrammable manipulator called "Unimate," from "Universal Automation."

The Unimation company was formed. It began to produce and market the robots. And now Engleberger is known in the industry as "the Father of Robotics." (8)

As many popular things, robots started to be shown in media too. Mostly either as hope or the embodiment of human fears.

Since 1900s robots were used to represent our uncertainty about our place in this world. That's where the fear of being displaced by machine (or even becoming one) began.

And that's why it appears as a common theme in popular culture, giving rise to some of the first robot characters.

In the 1950s and 60s, the world was recovering from war. Robots began to embody people's optimism for the future.

Toy robots provided the classic image of a robot in popular culture. (9)

Mostly in media life with robots is rarely a positive experience. A common plot is humanity's attempt to destroy the robots that are trying to replace humans (10)

But at the same time, the present is somewhat different from the movie prophecies. People mostly get attached to their robots, as, for example, has shown ‘Robots in the Wild: Understanding Long-term Use’.

Where it was noted that the owners of Rumba vacuum cleaners often gave them names, rearranged the plan of the apartment to make it easier for the work to move. The participants perceived them as part of the family, talked to them and humanized them. Teresa Flanagan, lead author of the study published in *Developmental Psychology*, says they chose Roomba because of the way it moves autonomously.

“But the Roomba can’t speak or doesn’t look like a human. So those are some things that might make us think that it doesn’t have as many mental or feeling or moral capacities.”

One 10-year-old said it wasn’t okay to yell at it because, “*the microphone sensors might break if you yell too loudly*”. Another 10-year-old said it wasn’t okay because “*the robot will actually feel really sad.*” (11)

References:

- 1 <https://scifisreal.com/automatons-what-they-are-and-where-to-find-them/>
- 2 <https://ugears.ua/avtomatoni-yakimi-buvajut-i-chim-vidriznyajutsa-vidrobotiv/>
- 3 <https://interestingengineering.com/innovation/the-history-of-robots-from-the-400-bc-archytas-to-the-boston-dynamics-robot-dog>
- 4 <https://www.aramcoworld.com/Articles/November-2019/Robots-of-AgesPast>
- 5 <https://blockplay.com.au/stem-projects/robot/>
- 6 https://en.wikipedia.org/wiki/Karakuri_puppet
- 7 https://en.wikipedia.org/wiki/Digesting_Duck
- 8 <https://cs.stanford.edu/people/eroberts/courses/soco/projects/1998-99/robotics/history.html>
- 9 <https://www.sciencemuseum.org.uk/objects-and-stories/friend-or-foe-robots-popular-culture>
- 10 <https://www.imdb.com/list/ls002048822/>
- 11 [https://cosmosmagazine.com/technology/explainer-why-people-are-making room-for-roomba-in-their-hearts/](https://cosmosmagazine.com/technology/explainer-why-people-are-making-room-for-roomba-in-their-hearts/)

RENEWABLES

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Renewable energy sources (RES) are sources that are naturally renewable. Renewable energy sources include periodic or steady flows of energy that are distributed in nature and are limited only by the stability of the Earth as a cosmoplanetary element: solar radiation, wind, hydropower, natural thermal energy, etc.

What prompted the world to think about switching to renewable energy sources? The main reason, in my opinion, was the environmental crisis, which is partly caused by toxic emissions from traditional energy resources (coal, wood, oil, gas, nuclear fuel, etc.), which in turn do not have endless reserves in the subsoil and on the surface of the Earth. Also, the generation of electricity from traditional energy resources can make a country that is limited in these resources dependent on other countries that import these raw materials. Therefore, states consider the transition to alternative energy sources to be promising in terms of stabilizing the domestic energy market, in terms of the environment, economic costs, and national security.

Solar panels are special devices designed to convert solar radiation into electricity. The principle of its operation is based on the use of photocells. A photocell is usually a flat semiconductor that can directly convert visible and infrared radiation into electricity. This process is called the "photoelectric effect," which was described by Albert Einstein, referring to the idea of German physicist Max Planck. The essence of the process is as follows: a photon hitting the photographic plate gives the electron certain energy, it begins to move actively and create a potential difference, i.e., an electric current. Solar energy services are mainly used by private individuals by installing photovoltaic panels on the roofs of their homes. They allow users to partially or fully provide for themselves, and in case of excess electricity, to transfer it to the general grid and earn a certain profit. In addition, heat collectors can

be installed to meet their hot water needs. The advantages of solar energy are its inexhaustibility and lack of emissions. Significant disadvantages are the instability of weather conditions and the problem of utilizing photovoltaic plates.

The principle of operation of a wind turbine is based on converting the energy of the wind flow into mechanical rotation of a wheel. Its advantages are environmental friendliness and independence from traditional fuels. As in the previous case, a significant disadvantage is unstable weather conditions that make it impossible to fully utilize wind turbines, which makes it necessary to place a wind turbine park in areas with suitable altitudes and weather conditions.

Geothermal energy is believed to be one of the most profitable energy sources. Much of this energy is found in magma. The Earth's heat is a real gem that has a number of advantages over gas, oil and nuclear energy. Geothermal power plants themselves can meet the demand for hot water and electricity. To do this, wells are drilled, and the steam or hot water from them turns a generator turbine under pressure to produce electricity. The obvious advantage of this type of generation is the conservation of traditional energy resources. The disadvantage is, surprisingly, the inadequate environmental friendliness that results from the emission of sulfur, mercury, boron, and ammonia compounds dissolved in groundwater into the atmosphere, as well as the significant cost of well construction in proportion to the depth of drilling.

Despite the fact that the renewable energy sector has a number of disadvantages, namely the involvement of large land areas that may subsequently be polluted by the same geothermal plants that run on biomass, increased noise levels (wind turbines), which can cause harmful effects on hearing aids and the human body in general, other harmful impacts on natural resources, mostly low capacity of renewable energy generation, critical sensitivity of generating plants to topographic and weather conditions, yet the advantages of this sector outweigh the disadvantages, although it is not a panacea. Any type of renewable energy will be many times more environmentally friendly than traditional methods of electricity production, and renewable energy does not actually require serious expenditures on raw materials; to

a large extent, raw materials are natural phenomena with endless resources (ultraviolet radiation from the sun, high-speed air flows, heat from the earth's interior, water resources, etc.).

References:

1. Renewable energy sources. (2023). Retrieved from: <https://efront.in.ua/vidnovlyuvani-dzherela-energiyi-vde/>
2. All about solar panels: types, characteristics, application features. (2023). Retrieved from: <https://130.com.ua/uk/vse-o-solnechnyh-panelyah/>
3. Pidlisna, A (2013). Alternative energy of Ukraine: prospects for the use of renewable energy resources [article], 7. Retrieved from: https://ela.kpi.ua/bitstream/123456789/19049/1/SPEP-11_09_Pidlisna.pdf
4. Wind turbines as an effective way to generate electricity. (2022). Retrieved from: <https://patriot-nrg.com/vitro-energetyka>
5. Geothermal power plants: advantages and disadvantages. (2019, December 14). Retrieved from: <https://avenston.com/articles/geothermal-pp-pros-cons/>
6. Zaporozhenko, A (2021). Improving the efficiency of energy supply of an industrial enterprise by using renewable energy sources [Master's thesis], 15-16, 21. Retrieved from: https://ela.kpi.ua/bitstream/123456789/46785/1/Zaporozhchenko_magistr.pdf
7. The environmental impact caused by the production of electricity. (2019, January 21). Retrieved from: <https://www.ez.rv.ua/vplyv-na-navkolyshnye-seredovyshe-sprychynenyj-vyrobnytstvom-elektrychnoyi-energiyi/>

RENEWABLE ENERGY

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First of all, renewable energy includes five main elements: wind, solar (photovoltaic), geothermal, hydropower, and biomass.

Wind power harnesses the energy of moving air through the use of wind turbines. These turbines employ large rotor blades installed at considerable heights on both land and sea to capture the kinetic energy created by the wind.

As the wind moves across the turbine blades, it leads to reduced air pressure on one side, creating a force known as lift, that pulls the blade downwards. The variation in air pressure across the two sides induces the rotation of the blades, setting the rotor in motion.

The rotor is connected to a turbine generator, which rotates to convert the kinetic energy of the wind into electricity.

Solar (Photovoltaic): Solar technologies capture sunlight and transform it into electricity. Photovoltaic (PV) solar cells consist of a semiconductor wafer with positive and negative sides, forming an electric field. When sunlight strikes the cell, the semiconductor absorbs it and transfers the energy as electrons, which are captured by the electric field in the form of an electric current. The generation of electricity by a solar system depends on factors such as the semiconductor material used and the prevailing environmental conditions. Geothermal: Geothermal energy originates from the Earth's core, where heat from the core heats underground reservoirs of water. Geothermal plants typically extract hot water from these reservoirs through wells and convert it into steam for a turbine generator. Reinjecting the extracted water and steam enhances the sustainability of geothermal energy, turning it into a renewable source. Hydropower: Much like wind turbines, hydropower plants, hydropower plants convert the kinetic energy of flowing water into electricity using a turbine generator. These plants are often located near bodies of water and utilize diversion

structures such as dams to alter the water flow. The amount of energy produced depends on the volume and change in elevation of the flowing water.

Biomass: Biomass, including organic materials like wood, dry leaves, and agricultural waste, has been a source of energy for heating since ancient times. Burning biomass in a boiler produces high-pressure steam, which rotates a turbine generator to generate electricity. While biomass is renewable because it can be regrown, emissions from its combustion can vary, and in some cases, they are higher than those from other clean sources. Additionally, biomass can be converted into liquid or gaseous fuels for transportation.

Renewable energy sources are essential in meeting the increasing global energy needs and combating climate change.

First of all, renewable energy reduces carbon emission. Traditional energy sources, such as coal and oil, release vast amounts of greenhouse gases into the atmosphere, contributing to global warming and climate change. Renewables, on the other hand, generate power with minimal or zero emissions, mitigating the environmental impact.

Secondly, it can give us energy independence. Unlike finite fossil fuel reserves, renewable energy sources are virtually inexhaustible. Sunlight, wind, and flowing water are abundant resources that can be harnessed for power generation. By diversifying our energy mix and reducing dependence on non-renewable resources, countries can achieve greater energy independence and security.

Consequently, the integration of renewable energy sources into the global energy landscape is not just a choice but a necessity. It offers a path towards a cleaner, more sustainable future, where energy needs are met without compromising the health of our planet. The continued dedication to renewable energy underscores a collective responsibility to safeguard the environment and construct a resilient and fair world for the well-being of future generations. Continuous advancements in energy technologies are making them more affordable and easily accessible leading to their adoption.

The rapid growth of the renewable energy sector has spurred technological

innovations and advancements. Research and development in areas like energy storage, smart grids, and efficiency improvements have the potential to reshape the entire energy landscape. These innovations not only enhance the performance of renewable systems but also contribute to broader technological progress.

The renewable energy sector creates job opportunities.

The renewable energy sector has become a significant driver of economic growth and job creation. The installation, operation, and maintenance of renewable energy infrastructure require a skilled workforce. As the industry expands, it generates employment opportunities, fostering economic development in both urban and rural areas.

Governments and businesses worldwide are increasingly investing in energy projects as they strive to build a future for all.

Governments and businesses around the world are making substantial investments in energy projects, driven by the shared goal of building a sustainable and inclusive future. These investments are instrumental in addressing pressing challenges such as climate change, energy security, and economic development. The commitment to energy projects reflects a recognition of the pivotal role they play in shaping the trajectory of societies and economies.

In summary, the future lies in renewable energy, urging us to invest in this sector and explore diverse alternative energy sources. Nowadays, we have five main types of renewable energy: wind, solar, geothermal, hydropower and biomass.

The central query is: "When will Renewable Energy Take Center Stage?" According to the International Energy Agency (IEA), global renewable electricity capacity is anticipated to surge by 60% by 2026 compared to 2020, surpassing 4,800 gigawatts. This capacity matches the present combined power generation from fossil fuels and nuclear resources. This projection highlights the inexorable evolution of the worldwide energy landscape, emphasizing that the shift to renewables constitutes a substantial and continuous paradigm change.

Nowadays embracing energy goes beyond fulfilling corporate social responsibility or seeking long term returns, in a low interest rate environment. There

are business incentives for private sector stakeholders to actively adopt resources. Here are some important reasons:

Reducing vulnerability to energy price fluctuations. With the nature of oil prices in years energy costs have become a major uncontrollable factor in business and economic planning. For instance, IKEA, the furniture giant aiming to achieve 100% energy by 2020 aims to enhance its energy independence have better control over profit margins and contribute to the preservation of natural resources while minimizing its environmental impact. As renewable energy solutions become more affordable and efficient generating power on site is becoming an option.

The transition towards renewables will create increased demand, across sectors. Although wind, sunlight and tidal energy sources hold potential it is crucial to convert this energy into electricity and ensure its effective delivery.

Simultaneously, the advancement of technologies to enhance the effectiveness of renewable power generation and storage has emerged as a substantial growth market, exemplified by Tesla's \$1.3 billion investment in a new gigafactory dedicated to manufacturing batteries for electricity storage. Enhanced renewable services have the potential to catalyse advancements in electric cars and innovative projects like the the Hyperloop, an innovative vacuum tube transit system anticipated to heavily depend on solar power, signifies a disruptive force in the energy sector. This disruption brings forth new investment opportunities. As technologies for extracting power from renewable sources and the accompanying infrastructure advance, technology companies are positioned to become key players in the evolving energy landscape. This trend is projected to gain momentum with the introduction of cutting-edge power generation technologies, fostering developments like photovoltaic paint and nano-engineered solar panels. The nanotech industry, in particular, holds significant importance in the evolution of renewable energy. Emerging applications such as nanofluids enhancing heat capture in geothermal plants, spherical core-shell nanoparticles boosting the efficiency of hydrogen storage, nano-cells extracting energy from surfaces like paint, glass, concrete, and brick walls, as well as superconducting cables based on carbon nanotubes, exemplify the potential

contributions of nanotechnology in the energy domain.

References:

Lobko, O. L. (2023, February 11). The Role of Renewable Energy. EcoMatcher. Retrieved October 13, 2023, from [https://www.ecomatcher.com/the-role-of-renewable-energy/Lobko, O. L. \(n.d.\). GM Set to Reach 100 Percent Renewable Energy in the U.S. 5 Years Ahead of Schedule. Retrieved October 13, 2023, from <https://news.gm.com/newsroom.detail.html/Pages/news/us/en/2021/sep/0930-renewable.html>](https://www.ecomatcher.com/the-role-of-renewable-energy/Lobko, O. L. (n.d.). GM Set to Reach 100 Percent Renewable Energy in the U.S. 5 Years Ahead of Schedule. Retrieved October 13, 2023, from https://news.gm.com/newsroom.detail.html/Pages/news/us/en/2021/sep/0930-renewable.html)

SHANE: ELECTRIC TWO-WHEELED VEHICLE THAT CAN CHANGE THE WORLD

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One of the most pressing ecological problems of the modern world is the negative impact of the high number of cars that use petroleum as their main source of energy. The automotive industry has expanded rapidly in the past decades, especially in developing countries, where the demand for personal mobility and transportation is high. However, this expansion has also brought significant environmental and social costs. Cars that use petroleum are responsible for a large share of the global CO₂ emissions and air pollution, which contribute to climate change and affect human health. According to the International Energy Agency, transport accounted for 24% of the total CO₂ emissions from fuel combustion in 2016, and road vehicles represented 74% of that share. Climate change, in turn, can lead to various health problems, such as respiratory and cardiovascular diseases, injuries and deaths from extreme weather events, infectious diseases transmitted by vectors or water, foodborne illnesses, and mental health issues. Furthermore, cars that use petroleum consume a finite and non-renewable resource, which increases the dependency on oil-

producing countries and creates geopolitical tensions. Additionally, the high number of cars on the road's causes traffic congestion and parking problems in many urban areas, which reduce the quality of life and productivity of the inhabitants. Therefore, it is imperative to find alternative and sustainable solutions to address the ecological problems caused by the high number of cars that use petroleum.

To address these issues, Shane Chen, the inventor of the original Hoverboard, has developed a novel concept of a two-wheeled electric car, called SHANE, that aims to revolutionize the way people drive. SHANE is the first feasible and efficient two-wheeled car concept that can be used for both urban and highway driving, while taking advantage of the laws of physics to create a futuristic ride.

Some of the main features of this car concept are as follows.

- **Stability:** The SHANE has a mechanism that adjusts its center of gravity according to the position of the wheels, which ensures stability and safety comparable to that of a conventional four-wheeled car, even under driving and braking forces.
- **Maneuverability:** The SHANE is designed to make driving and parking easier, as it has two-wheel differential speed control, which eliminates the need for a complex front-wheel steering system.
- **Energy Efficiency:** The SHANE boasts large wheels that minimize rolling resistance, in addition to in-wheel regenerative shocks that recuperate damping energy, which is subsequently utilized to recharge the battery.

Ultimately, SHANE is a groundbreaking car concept that offers a solution to the environmental and social problems caused by the conventional automotive industry. By using only two wheels, SHANE reduces its size, weight, and energy consumption, while maintaining its stability, maneuverability, and performance. Compared to other electric cars, SHANE has a unique design that makes it stand out from the crowd and provides a new driving experience for motorists. SHANE is not only a vehicle, but also a vision for the future of mobility.



References:

1. Production statistics. OICA. (n.d.). Retrieved from <https://www.oica.net/category/production-statistics/2022-statistics/>
2. IEA. Summary tables. (2019). CO2 emissions from Fuel Combustion 2019 Edition, pp. 96–98.
3. Hoverboard inventor introduces a Revolutionary parallel, two-wheeled electric car invention. (2023, October 17). *Inventist*. Retrieved from https://inventist.com/files/docs/SHANE_press-release.pdf
4. Rivers, S. (2023, October 17). The Shane is a giant self-balancing hoverboard with room for five. *Carscoops*. Retrieved from <https://www.carscoops.com/2023/10/embargo-october-17th-11am-et-the-shane-is-a-two-wheeled-ev-concept-car-with-room-for-four/amp/>

GLOBAL WARNING

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Many people are confident that our current lifestyle is exerting an extremely harmful and detrimental effect on the environment. Pollution of ocean, land, air with polymers gases produced by burning of fossil fuel, all of these are creating harmful ‘greenhouse effect’ and ozone hole.

Greenhouse effect is a process that is taking place when Earth's atmosphere

gases trap the Sun's heat. The Earth is getting warmer every year. This process is also known as global warming.

Global warming is defined as a gradual average temperature rise of the Earth's atmosphere. The first such increase happened after the period of Industrial Revolution. At that time a record increase in Earth's average temperature has been stated: the temperature level has risen by zero point seven degrees Celsius. This immediately caused a stir in a scientific community as it was a sign of global warming, which causes the ice melting, and the rise of both sea level and temperature. Consequently, this serves as a reason of serious flooding and violent storms in many parts of the world while turning other parts into lifeless deserts. (Palmetto, 2023).

Global warming is considered as a key reason of climate change. Thus, making it difficult for flora and fauna of a particular ecosystem to survive. For instance, in the Arctic the survival of polar bears is now called into question. Over the last few decades, a number of skin cancer patients has increased by 33 per cent worldwide due to ozone hole. (National Geographic, 2022).

This problem should be solved now if we plan to avoid or, at least, reduce the negative outcomes for our planet, and create a healthy environment for future generations. There are many things that we could do to help preserve and save our planet.

First and foremost, ordinary bulbs can be replaced by LED light bulbs, not to mention that turning off lights, TVs, laptops as well as other electrical items, anytime when they aren't used, can significantly cut down on electricity consumption. Isolating the attic can help to avoid the waste energy. Using double glasses on windows and doors will decrease the heat loss. By doing so, not only will you help the environment, but also, you'll get a huge plus in terms of lower utility bills. It seems as small and insignificant things but it's of a huge help when it comes to protecting the environment from further destruction. What's more, alongside with our efforts to save energy and resources, recycling plays a huge part as it assists in reducing the garbage level and purifying the nature.

Secondly, it is time to rethink our way of commuting. Using your own car is good for you but, to our great regret, the same cannot be said about the environment. Cars burn fuels and, consequently, pollute the environment. Thus, we can use public transport or bicycles instead. (United Nations, 2023).

Another crucial step is buying loose products to reduce the number of packages. By consummating local products, not only will we help the local manufactures and, thus, economy but also, we will ensure that minimal energy amount was spent on the transportation (NRDC, 2022).

In addition, it's high time to look at alternative energy sources such as sun, wind or wave power. For instance, car manufacturers have already started producing cars of a new type known as hybrids. It works like an electric car but also has a small petrol engine.

In conclusion, I would like to say that we are facing this problem for the first time. If we do the right things, we can make our world a better place for our future generations.

References:

- 1) Palmetto. (2023). *What is global warming*. Retrieved from: <https://palmetto.com/learning-center/blog/global-warming-definition-causes-and-effects>
- 2) National Geographic. (2022). *Global warming*. Retrieved from: <https://education.nationalgeographic.org/resource/global-warming/>
- 3) NRDC. (2022). *Global Warming 101*. Retrieved from: <https://www.nrdc.org/stories/global-warming-101#effects>
- 4) United Nations. (2023). *Climate Change: act now*. Retrieved from <https://www.un.org/en/actnow/ten-action>

THE IMPACT OF ROBOTIC INTEGRATION ON THE LIFE OF MODERN SOCIETY

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Nowadays, we cannot live better without modern technologies, that make our lives much easier. Mostly, our lives consist of interacting with artificial intelligence, which is embedded in devices such as phones, laptops, PC's and even mainframes, that are using by scientists in order to process large amounts of specific data or to do ecology monitoring. The programmers can continue to improve AI technologies, but what if these technologies soon make our lives so easy that we don't have to do anything? Is it possible to say that the impact of robotization is positive for society or is it possible to make the opposite statement?

The social argument against the growing part of artificial intelligence in our lives is changes on the job market. The reality of robotization is that some professions based on automatic actions can be replaced on the robot's labor. And as a result, many people around the world will not be able to work in their professions. Moreover, the increased involvement of robotic technologies in our lives will require more attention to intensive using the renewables, because it will be needed more electricity for the increasing pace of robotization, while the people activity do not need electricity to work.

On the other side, the development of artificial intelligence will advance the activities of scientists, most of the actions, that can be automated, will be automated, and the bright minds of scientists will be involved in solving more important issues related to improving artificial intelligence technologies. AI technologies are usually used by high-level scientists in order to increase the productivity of their researches.

Robots can do all the most complicated robot work instead of humans. Such complex work includes demining dangerous military territories, transporting the wounded from the battlefield, researching anomalies and so on, as robots are not a

pity to sacrifice. If it is possible to establish the production of such robots, it will significantly improve people's lives.

In conclusion, artificial intelligence is a necessary factor, which mainly has the positive influence on the development of humanity in the 21st century, but it also worth to pay attention to the ecology surrounds us, do not let the mechanization process ruin our nature. Now we have the progress in science and IT, we will also achieve the greater results in it and create the breathtaking things that we have never used before, it is just worth to memorize that the nature resources are not infinite, so in this reason we need to use renewables instead.

References:

1. Anderson, J., & Rainie, L. (2018, December 10). Improvements ahead: How humans and AI might evolve together in the next decade. *Pew Research Center*. Retrieved from <https://www.pewresearch.org/internet/2018/12/10/improvements-ahead-how-humans-and-ai-might-evolve-together-in-the-next-decade/>
2. Ganesh, S. (2023, March 24). How Robots Can Make a Positive Impact on Our Future? *Analytics Insight*. Retrieved from <https://www.analyticsinsight.net/how-robots-can-make-a-positive-impact-on-our-future/>
3. How will the integration of Robots affect our society [Electronic resource]. Aries Robotics. 17 January 2023. Retrieved from <https://ariesroboticsai.com/how-will-the-integration-of-robots-affect-our-society>

TECHNOLOGICAL BREAKTHROUGHS

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Technological progress has been a determining factor in the development of human civilization throughout its history. Every new discovery or invention that made people's lives easier and expanded their capabilities was a revolutionary step forward. The first simple mechanisms and tools gave rise to more sophisticated

technologies that eventually radically changed the face of the Earth. In this report, I will try to trace in detail the main stages of human technological progress and outline the likely direction of further technological development.

The first technological revolutions were associated with the emergence of crafts and the first mechanisms that facilitated human physical labor. Further important inventions were related to the use of water and wind energy and the creation of engines. However, the real technological breakthrough occurred during the Industrial Revolution of the 18th and 19th centuries. The massive use of steam engines, the development of metallurgy, and the emergence of conveyors and railroads transformed the world.

The next revolutionary step was the widespread use of electricity and electric motors. This radically changed industrial production, everyday life, and transportation. Technological progress in the 20th century accelerated incredibly thanks to advances in electronics, computing, and computer science.

Today, the world is experiencing another wave of technological revolution, driven by automation, robotics, artificial intelligence, and other breakthrough technologies. They bring the capabilities of humanity to a new level.

The future. An analysis of past technological revolutions shows that progress is gaining momentum. The pace of inventions and implementation of new technologies is constantly growing. We can hope that in the coming decades, humanity will make another technological breakthrough.

Further development of information, bio- and nano-technologies is a promising area. Their convergence may open a new era in the history of civilization. At the same time, technological progress poses certain threats that will require careful analysis and regulation at the international level.

So, technological progress is gaining momentum and fundamentally changing life. The most breakthrough achievements are yet to come. Society needs to be prepared for the challenges of the future and use new technologies for the development of humanity.

References:

1. History of technology. (2021, October 12) Retrieved from: <https://www.britannica.com/technology/history-of-technology/The-urban-revolution-c-3000-500-bce>
2. Why did 99 percent of the technical progress of modern man occur in the last 10,000 years? (2013, June 21) Retrieved from: <https://slate.com/human-interest/2013/06/human-advancement-why-has-so-much-of-our-progress-come-so-recently.html>

ALTERNATIVE ENERGY SOURCES, PRODUCTION AND USE

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Agriculture is very important in Ethiopia's countryside. It makes up 51. 8% of the country's economy and provides jobs for 86% of the people. In Ethiopia, almost all of the fuel used comes from plants and trees, which is called biomass. About half of this biomass fuel is used for making a traditional food called injera. The rate at which trees are being cut down is 1. 1% every year This is causing harm to the environment and making us lose important resources. Dried cow poop is commonly used as a fuel because there is not enough fuel available. Wood and cow poop burn differently and have different levels of efficiency. The burning of fossil fuels and using a lot of firewood has created dirty air and cut down many trees, which has led to less rain and not enough food for people.

Biogas digestion was brought in to help with problems in developing countries like not enough energy, cutting down too many trees, and worries about the environment. It has advantages like making more crops and better fertilizer. However, not many people in Ethiopia use it. It is really important to study different designs and materials for biogas plants so that we can spread the technology effectively.

In this article I want to study biogas plants economically, we need to think

about the costs of the fuels we usually use, the advantages of using biogas, and the effects on the environment. This includes looking at how biogas reduces the need for fuelwood, cow dung, and chemical fertilizer, which happens when we use biodigesters.

In rural Ethiopia, people rely on fuel wood and charcoal for energy, spending significant time and effort gathering firewood. Deforestation, environmental degradation, air pollution, and high spending on firewood are prevalent issues.

Renewable energy sources offer a clean and efficient cooking fuel alternative to mitigate these challenges. Biogas technology is used in Ethiopia but faces obstacles due to the complexity of building and installing fixed-dome and portable plants.

To address these issues, research was conducted on plastic geomembrane biogas plants, which have a tube-like shape. Testing slurry production and economic viability is essential in solving the problem. This research focuses on improving biogas adoption in rural Ethiopia.

Biogas generation could be a moderately moderate handle happening over a period of a few days. The rule response taking put in anaerobic digester is continuous but simultaneous. The diverse stages of the method are solubilization (hydrolyzing stage), corrosive era (non-methanogenic stage) and methane era (methanogenic stage).

The primary step includes the solubilization of complex natural materials constituting the digester food stock. They are composed of carbohydrates, fats, protein, nitrogen compounds, salts and flotsam and jetsam. Within the second arrange, the microscopic organisms decrease the solvent natural fabric from the primary step to dissolvable basic natural corrosive. Within the third step methane microbes decrease natural corrosive essentially acidic corrosive and certain other oxidized compounds to methane and carbon dioxide.

As there may not be coinciding between the time of accessibility of new slurry and time of field application fluid slurry be legitimately put away or composted. So it is suggested to develop 2 or 3 compost pits closer to the biogas plant so as to preserve

supplements and increment edit abdicate.

No shape of biogas slurry can be productively cleared out spread on the field. Areas ought to be furrowed quickly, or on the off chance that the excrement is utilized as top-dresser, ought to be secured by soil quickly to preserve supplements.

Considering the long-term good thing about plastic film biodigester innovation both financially and naturally, it is suggested to present the single layered over ground geomembrane plastic biogas innovation to be utilized for the recipients notwithstanding of its higher gas and aged slurry generation by means of expansion instruction to advance its infiltration and dissemination into country regions. In any case, more noteworthy security safety measure amid operation and utilization of the plant and assurance from harming operators such as honed objects and rats is fundamental.

Investigate, improvement and show are basic exercises to overcome the specialized impediments and be well side by side of improvement in biogas innovation. Hence, similar studies have to be practiced within the good countries of Ethiopia by including agriculturists, making criticism from the agriculturists and letting this input serve as a establishment for the advancement of the innovation.

The government offices such as Division of Environment, Division of Horticulture and Country Advancement, Farming Expansion Center, and indeed private teach might play a leading role by the issue of advances, endowments and mindfulness creation expansion instruction administrations. This might be actualized beneath government controls and arrangements.

Reference:

Yimer, B. (2014, February 1). *Alternative energy sources to combat climate change: Biogas production using cost effective material*. Anchor Academic Publishing (aap_verlag).

ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Ukraine is considered to be one of the countries with a deficit of water resources. It is among the European countries with the biggest water shortage. Russia's bloody war against Ukraine has greatly worsened the situation.

The continuous bombardment and artillery attacks on urban areas resulted in the discharge of a significant quantity of hazardous chemicals into the surroundings. The complexity of this issue arises from the fact that explosions from munitions release various detrimental substances that eventually infiltrate groundwater and subsequently enter surface water, leading to a substantial adverse effect on water resources.

The shelling leads to significant releases of nitric acid into the air. Concentrated nitric acid is prone to intense evaporation upon contact with the atmosphere, resulting in the formation of nitrogen dioxide. This compound readily dissolves in water, giving rise to nitric acid. This process leads to acid rain and has a profound impact on living organisms. Owing to its high solubility in water, nitric acid vapors swiftly infiltrate soils and groundwater, causing a rapid increase in their acidity levels. This, in turn, leads to widespread devastation among the ecosystems in the affected areas (Angurets, 2023).

The integrity of sewage systems faces continuous disruptions, and pipes lose pressure in the areas affected by shelling along the front lines in the Donetsk, Luhansk, Zaporizhzhya, Mykolaiv, and Kherson regions. Assessing the present extent of sewage water leakage into the soil and groundwater across Ukraine's entire territory remains unfeasible and will remain so until the war concludes. Additionally, the recurring shelling-induced power outages impede the proper operation of water-pumping systems within treatment facilities and disrupt the oxygen levels in the water (Rubryca, 2023).

Another important problem related to the disruption of the work of treatment facilities is the departure from the occupied territories of qualified specialists responsible for the maintenance of these facilities. Ukrainian scientists had to suspend their work due to problems with the supply of water and electricity, destroyed laboratories, forced evacuation. The loss of specialists significantly worsens the problem of water resources management (Stein, Birnbaum, 2023).

It is a recognized fact that military operations result in both mechanical and chemical contamination of water bodies and groundwater. Among the most significant causes are the widespread submersion of military vehicles and ammunition in water bodies, the release of oil-based products and various chemicals stemming from the destruction of major industrial sites, and the biological contamination due to the accumulation of human and animal corpses (Gleick, 2023).

Due to the terrorist attack carried out by the Russians at the Kakhovskaya Hydroelectric Power Plant, a deliberate submersion of a considerable amount of military equipment occurred. The submersion of various types of military equipment results in substantial water pollution from metal ions. Tons of steel corrode, aquatic ecosystems become overloaded with these metal ions, which are harmful to the environment. Additionally, each submerged unit of military equipment releases significant quantities of petroleum products used in its operation, such as diesel fuel, gasoline, oils, and lubricants. Oil and oil products are extremely toxic (Vogler, 2023).

References:

Angurets O., Khazan P., Kolesnikova K., Kushch M., Cernochova M., & Havranek M. (2023, 20 March). *Environmental consequences of Russian war in Ukraine* 2022. Retrieved from <https://cleanair.org.ua/wp-content/uploads/2023/03/cleanair.org.ua-environmental-consequences-of-russian-war-in-ukraine-war-damages-en-version.pdf>

Gleick, P. (2023, 28 September). *Rivers and water systems as weapons and casualties of the Russia-Ukraine war*. Retrieved from <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2023EF003910>

Rubryca. (2023, 23 December). *10 environmental consequences of russia's war*

in Ukraine. Retrieved from <https://rubryka.com/en/article/naslidky-viiny-dlia-dovkillia/>

Stein, J., & Birnbaum, M. (2023, 13 March). *The war in Ukraine is a human tragedy. It's also an environmental disaster.* Retrieved from <https://www.washingtonpost.com/world/2023/03/13/ukraine-war-environment-impact-disaster/>

Vogler, A. (2023, 12 July). *The environmental costs of Russia's war of aggression.* Retrieved from <https://www.ips-journal.eu/topics/economy-and-ecology/the-environmental-costs-of-russias-war-of-aggression-6840/>

ALTERNATIVE ENERGY REQUIRES THE MOST DEVELOPMENT TO MEET THE GLOBAL NEEDS OF HUMANITY

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Alternative energy is a global sector that requires the most development to meet the global needs of humanity. Alternative energy sources include solar, nuclear, wind, geothermal, bioenergy, hydro, and ocean energy. It's clear that life on Earth is impossible without energy. Just yesterday, humanity needed to replace depleting energy sources, namely oil, gas, and coal, with alternative ones because we don't fully understand the significance of these natural resources for our ecosystem and the planet as a whole. We should contemplate the importance of the natural balance that existed before the development of technological progress.

But how can humanity predict the amount of energy it will need for its own requirements? There is a vast amount of statistical data shared by scientists in scientific articles, interviews, and conferences. They all converge on one point - the demand for energy resources will continually increase. Picture 1 illustrates the amount of energy consumed in 2023 (478,056,865 terajoules), recorded by the author at 15 hours, 35 minutes, and 22 seconds on October 28, 2023.



Picture 1. Statistical data on energy. Recorded by the author at 15 hours 35 minutes 22 seconds, October 28, 2023. (The world counts. Energy)

What does this tell us? Global energy consumption, since 2000, has increased by about a third. We can see these changes in the following table:

Current year	Global energy consumption (terajoules)	Percentage
1980	300 000 000	300 %
2040	900 000 000	

Table 1. Calculated by the author based on the obtained data. (The world counts. Energy)

To confirm the reliability of the obtained data, we will take an officially confirmed diagram from The International Renewable Energy Agency (IRENA):

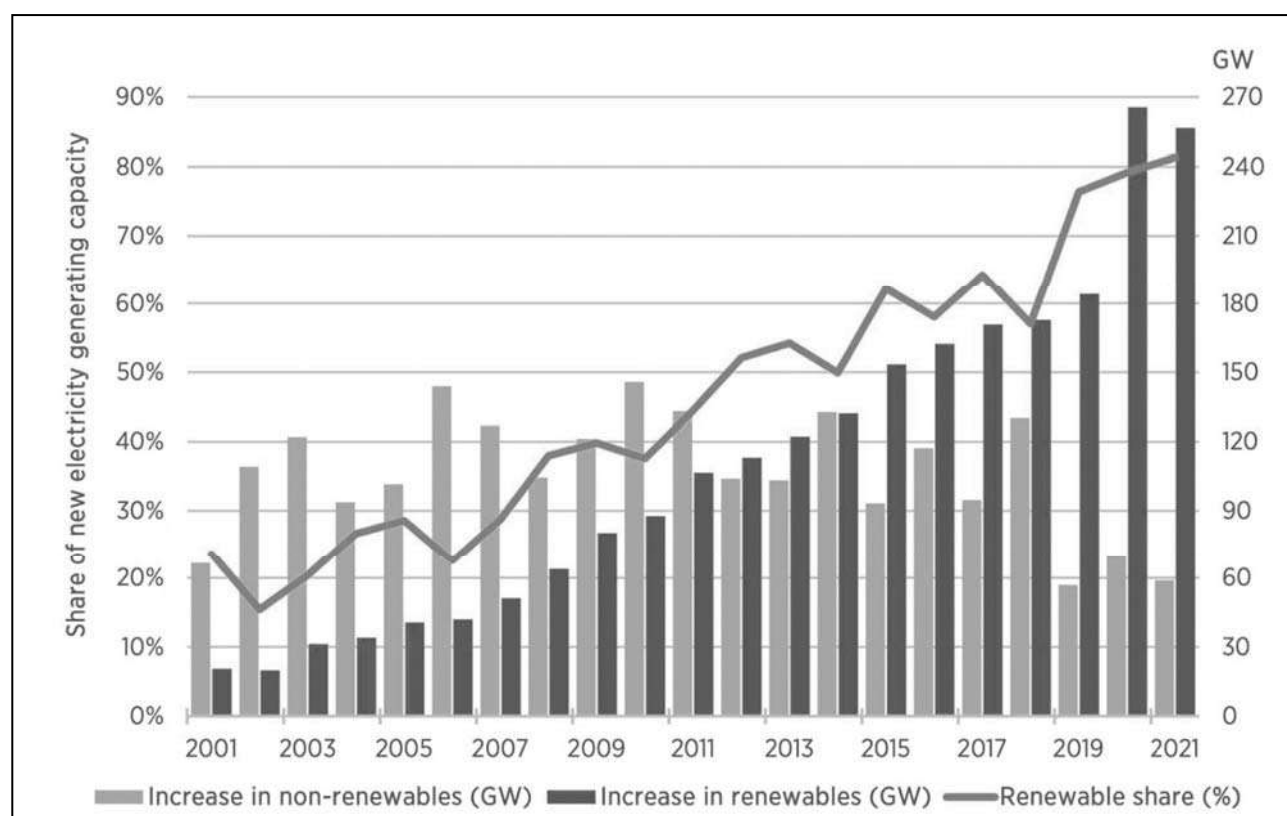


Table 2. Renewable and non-renewable share of annual power capacity expansion. (Avenston. IRENA)

2021 has reached 80%. Therefore, a 300% increase of the generated energy is a completely realistic indicator for 2040. But the author has cast doubt on the figures regarding non-renewable energy sources for the years 2019-2021. Have people truly started to divest from investments in oil, gas, and coal? In reality, it's only a matter of time before most countries will be able to autonomously provide their citizens with renewable energy. But even at this early stage, the so-called “green energy bugs” are beginning to emerge. And here is the reason why: the energy crisis is a crisis of climate and inequality. Historically, the premise that economic growth “lifts all boats” has justified maximizing growth, which “free market” proponents often interpret as demanding minimal regulation and redistribution (Science. The climate crisis is a crisis of inequality). But this growth requires energy, which largely comes from burning fossil fuels, the major cause of the climate crisis (Science. The climate crisis is a crisis of inequality).

So, when we talk about alternative energy, it's not just about technological progress, but also about economic, political, and social aspects. We can see how societal awareness aligns with narratives of environmental conservation. Therefore, from the perspective of logical positivism, alternative energy requires the most development to meet the global needs of humanity.

References:

1. Avenston. IRENA. Renewable share of annual power capacity expansion. (28.10.2023). <https://avenston.com/articles/renewable-capacity-2021/> ;
2. Science. The climate crisis is a crisis of inequality. (28.10.2023). <https://www.science.org/doi/10.1126/science.adk3500> ;
3. The world counts. Global challenges. Energy. (28.10.2023). <https://www.theworldcounts.com/challenges/climate-change/energy/global-energy-consumption>.

ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Even in the last century, humanity did not realize the importance of environmental problems. The consequence of this was that humanity focused its attention on increasing production capacity, while neglecting efficiency and environmental friendliness. As a result, up to 3 million tons of polluting rivers, such as industrial waste from factories, were thrown into the rivers of our planet. (Knush, 2021)

According to statistics, 90% of the population of Ukraine uses water from surface sources for their own needs, the quality of which only worsens every year. There are many reasons for the deterioration of surface water quality, for example, an outdated water treatment system at enterprises that does not meet water treatment standards. The consequence of this is that the vast majority of water bodies in Ukraine have the 3rd level of pollution. According to state water quality standards, this level of pollution is a significant deviation from the norm. (Yatsyk, 2018)

Also, we should not forget about the environmental consequences for water resources due to the explosion of the Kakhovka HPP. According to the researchers of the informNapalm project, the consequences of blowing up the Kakhovka HPP can be compared with the use of nuclear weapons, in terms of the scale of pollution. One of the reasons for such consequences should be considered that during the detonation of the hydroelectric power station, there was a leak of oil, with a volume of up to 450 tons, due to which film on the surface of the water will limit the access of oxygen to the water, as a result of which a huge number of fish died. Taking into account the data of the world data center, as a result of this disaster, the biodiversity in the Dnipro was caused colossal damage also due to the one-time discharge of a large volume of water. (Selyk, 2023)

At this moment, humanity has many ways to solve environmental problems

related to water resources, such as using the latest resources in the field of water purification. It would also be quite effective to regulate illegal discharges of pollutants into water bodies, making these discharges impossible in the future. (Yatsyk, 2018)

References:

1. Selyk, V. (2023, August 19) Kakhovskaya HPP and the consequences of its detonation. Retrieved from <http://wdc.org.ua/uk/kakhovska-hpp-flooding-scenarios>
2. Knush, K. (2021, October 18). Offshore wind energy and "green" hydrogen: discovery of new frontiers of energy power of Ukraine. Retrieved from https://www.ive.org.ua/wp-content/uploads/2_5438583199909284286.pdf.
3. Yatsyk, A. (2018, November 14) Water-ecological problems of rivers of Western Polissia of Ukraine. *Agrovisnyk*. Retrieved from https://agrovisnyk.com/pdf/en_2018_10_09.pdf.

TACKLING THE ISSUE OF WASTE CRISIS

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In the modern world, the problem of the garbage crisis is acute. Humanity does not realize that their actions create a lot of problems for our planet.

Every year, global production produces a wide variety of goods, which, as a result, causes a huge amount of waste. According to the World Bank, about 2 billion tons of solid household waste are generated annually. Analysts predict that by 2050, this figure may increase by almost one and a half times. Such a trend is not very encouraging for the development of our planet.

How is waste disposed in the world?

- 37% remain polluting the climate in landfills;
- Unfortunately, 33% brazenly dumped;
- 13.5% undergo processing;

- 11% are simply burned;
- Only 5.5% is compostable.

It seems, why can not use traditional methods of disposal? The answer is simple, this option becomes more problematic due to a number of restrictions imposed on such types of processing. (UBQ Editorial Team, 2023).

A perfect idea for reducing waste in global manufacturing could be a project started in several states. The essence of this method is to reuse the container. More precisely, every bottle (and other containers) will be recycled and sold again. The implementation of such technology imposes a significant responsibility on manufacturers of various products. This technology will help reduce waste emissions almost in half. Despite all the complexity of this procedure, it will be a good start to reduce the amount of waste. (Gibbens, 2023)

Solving the problem of the waste crisis should concern all manufacturing companies, but the greatest attention should be paid to food companies. After all, they occupy a leading place in the chain from production to consumption.

The first step to launching this solution is to grow the products. A rather important aspect is the care of flora and fauna. After all, cooperation with farmers will help to improve the qualitative and quantitative composition of both plant and animal products. At this stage, it is important to learn how to farm with minimal chemical exposure and post-harvest losses.

The second step will be customer awareness. As trite as it sounds, most people do not pay attention to problems of a global scale. Therefore, it is very important to teach humanity to see the problems, to inform about the amount of waste and to teach them to buy, consume and throw away products wisely.

Another important tip is to improve people's awareness of product expiration dates. Companies such as General Mills and Nestle USA have established clear date markings such as “sell by”, “best before” and “use by”. Although this method is simple, it goes a long way in reducing consumer confusion about these dates and will reduce unnecessary food waste.

Another great way out of the garbage crisis, I can offer the cooperation of

several companies. This method consists in combining the efforts of several companies and a detailed study of forecasts of consumer demand. This will be a good driving force not only for large companies, but also for small businesses and farmers. By looking at the analytics created by the joint companies, they will be able to focus only on the production of the necessary products. This method requires the creation of complex interactions between many links, but once it is involved, success is guaranteed one hundred percent.

The last way to solve the grid problem, which is used in Europe, is waste-to-energy. Garbage is burned on specially equipped bases, producing heat and electricity from it. This method is quite popular in European countries, currently 23% of solid waste in the EU is subject to incineration, and in Scandinavian countries this figure reaches 58%. Also, biogas plants are increasingly being used. They are installed in landfills or places where agricultural waste accumulates. They work on the basis of methane fermentation of biomass and produce biogas. This method is developing extremely dynamically. After all, in 2000 there were only about a thousand biogas plants in Germany, and in 2018 - already 9.5 thousand.

Experts emphasize, if global waste was managed all over the world as it is in some parts of Europe, i.e., more recycling, use of waste-to-energy process and the limited use of landfills, it would reduce greenhouse gas emissions by 1 billion tons per year. Summing up, we can say that solving any problem, even if it is not of a global scale, always requires a lot of effort, money and time. Looking at the development and trends of the modern world, it can be assumed that the problem with the garbage crisis is not hopeless and will definitely be solved in the near future.

References:

1. UBQ Editorial Team (2023, February 9). UBQ Tackles the Global Waste Crisis. Retrieved from <https://www.ubqmaterials.com/blog-post/ubq-tackles-the-global-waste-crisis/>
2. Gibbens, S. (2023, January 17). Why your recycling doesn't always get recycled. Retrieved from

<https://www.nationalgeographic.com/environment/article/why-recycling-plastic-doesnt-always-get-recycled>

RENEWABLES

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The current era is of great significance for researchers in power systems, as it shares similarities with the transformative period that followed the liberalization of the electricity sector in the late 1990s. This transformative nature is primarily driven by the pressing concern of climate change and the imperative to mitigate greenhouse gas emissions. While the full extent of climate change impacts may span decades, centuries, or even millennia, the consensus is clear: urgent action is needed to curb emissions and avert the worst, irreversible consequences of climate change.

Simultaneously, the world grapples with concerns over an impending energy crisis, stemming from the depletion of fossil fuels. In response to these challenges, renewable energy has assumed a pivotal role on the global stage, capturing the attention of governments, industries, and society at large. This paradigm shift has been accelerated by international agreements aimed at reducing carbon emissions, escalating energy demand, and the imperative to ensure energy security.

Energy supplies derived from renewables, encompassing biofuels, solar technologies, wind power, hydropower, geothermal energy, and more, have become a crucial component of every nation's energy strategy. These renewable sources address pressing concerns for both local and global environmental preservation, energy security, and sustainability. Given the urgency of climate change and the imperative to reduce carbon emissions, keeping fossil fuels underground has become imperative to prevent the release of carbon dioxide and methane into the atmosphere. Achieving this requires a substantial expansion of renewable energy capacities alongside efficient energy utilization. The good news is that such a transformation is already

underway.

Over the last five decades, scientific advancements, technical innovations, manufacturing growth, and economic impacts related to renewables have experienced exponential growth. This remarkable progress, which began around the 1973 oil crisis, shows no signs of slowing down. The integration of modern renewables with digital electronic control and advanced communication systems has led to a second industrial revolution. This time, the driving force is energy harnessed from and returned to the natural environment, in stark contrast to the era of fossil fuel dependence.

Renewable energy sources have emerged as the linchpin in the transition to a low-carbon future, with wind power emerging as a frontrunner in this transformation. A significant factor contributing to this evolution is the favorable support policies and incentives that renewable power producers received during the early stages of their deployment, enabling them to participate in power generation while mitigating market risks.

Notably, renewable energy costs have consistently declined, bringing various technologies, such as wind and solar, closer to grid parity. Consequently, renewables are not only expected to coexist with conventional energy sources but also to compete within the marketplace. However, it is essential to acknowledge the fundamental distinctions between renewable energy technologies and conventional sources, excepting hydro and biomass. Renewable sources are characterized as non dispatchable, with limited control over their output, and subject to stochastic variations, rendering advance prediction challenging.

As long as we prioritize ecological sustainability, the multifaceted benefits of renewables promise to bring distinct advantages to humanity.

References:

Bull, S.R. (2001). Renewable energy today and tomorrow. *Proceedings of the IEEE*, 89(8), 1216-1226.

Morales, J.M., Conejo, A.J., Madsen, H., Pinson, P., & Zugno, M. (2013). Integrating renewables in electricity markets: operational problems. *Springer Science*

& *Business Media*, 205.

Olabi, A.G., & Abdelkareem, M.A. (2022). Renewable energy and climate change. *Renewable and Sustainable Energy Reviews*, 158, 112111.

Twidell, J. (2021). *Renewable energy resources*. Routledge.

SMART TECHNOLOGIES IN SCIENCE AND ART

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Describing a definition of something, being as diverse as smart technologies, may be quite not a simple task but in ordinary live we often use these words for something totally innovative and at the same time vastly spreadable in all society and not only scientists' community. Analyzing world tendencies, refer to the conception of the information society where it's impossible not to work with the great amount of information from different flows. Also, it provides integration of computing and telecommunication into other ones that previously didn't have such opportunities. 'What makes a technology 'smart' is its capability to communicate and work with other networked technologies, and through this ability to allow automated or adaptive functionality as well as remote accessibility or operation from anywhere (Campbell, 2019, p.1)' – that's how we can describe the main difference of that technology.

Nowadays, there are a lot of products with the heading of 'smart' that often overlap with cloud technologies, Internet of things, and AI. Initially, the term SMART was used for self-monitoring, analysis and reporting technologies but according to modern usage it defines systems that can respond to changes in own environment based on input and control and the ability to steer are main in the context of automatic systems. And the use of smart technologies continues to increase yearly.

The room for the implementation of such innovative things in different areas of human activities is huge and may be divided by various purposes: in home

technologies, logistics, factories, for creating multitasking programs for different researches and in analyzing big information flows. Progress developing achievements for rationalization of investigations nowadays operate with such possibilities as:

- Analyzing large datasets with great accuracy and speed for personalized medicine, tending to individual lifestyle habits, for finance systems, sensor systems of environment conditions and prevention;
- Automatization of information searching and representing systems due to purposes of askers that can be widely used for fast data-mining and the subject of further research of the impact of it using in studying, everyday life, making statistic predictions;
- Machine learning algorithms for engineering systems and creating automatic control systems;
- Virtual and augmented reality as for simulations of real-life experiments or scenarios, as for entertainment and game industry developing.

When it comes to the artistic part of smart technologies that are involved for ordinary users, graphic creators based on artificial intelligence have made essential progress in both technology and quality in last 2-3 years. Databases of such systems rise by implementing pictures in all styles and genres to correspond searches by their key words.

Finally, ‘Researchers can now use technology to automate data collection and analysis, collaborate remotely, and disseminate their findings online. Additionally, technology has become a subject of research, with researchers studying the impact of technology on various aspects of life (Qudus, 2023, p.2).’ But there might be bounds in developing such technologies because humans don’t live in datasets but continue changing for the better based on a savvy that’s not typical even for smart machines. Therefore, even referring technologies as smart doesn’t exclude that they cannot but follow a script, though that script allows reorganizing to better performing on a task given. It is matter for human beings to distinguish the difference between fragile human acuity and precocious machines that have been become as result of human ingenuity.

References:

1. Campbell, C. (n.d.). *What is “smart” technology?* Google Docs. <https://docs.google.com/document/d/1p8Yjkctv3gtw4PMqX5iK6TdSvnnDPpYjbfqCTabXXdc/edit>
2. *What is smart technology and what are its benefits?* RSS. (n.d.). <https://www.rezaid.co.uk/post/smart-technology-and-its-benefits>
3. Qudus, I. (2023, April 20). *Idowu Qudus*. Expaat. <https://www.expaat.co/what-is-the-importance-of-technology-in-research/#:~:text=Researchers%20can%20now%20use%20technology,life%2C%20including%20healthcare%20and%20education>
4. Hildebrandt, M. (2020, December 17). *Smart technologies*. Internet Policy Retrieved from <https://policyreview.info/concepts/smart-technologies>

DESIGNING THE FUTURE: THE ROLE OF CAD SOFTWARE, NEW MATERIALS, 3D PRINTING, AND NEURAL NETWORKS IN MODERN DESIGN PRACTICES

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The development of Computer-Aided Design (CAD) software has revolutionized the way designers approach their work (Omura G., 2021, P.293). This software allows designers to create, modify, and analyze designs in a digital format, providing greater precision and flexibility in the design process. CAD software has become an essential tool in various fields, including architecture, engineering, and product design. It has significantly reduced the time and cost involved in creating and modifying designs, enabling designers to experiment with different ideas and iterations quickly. CAD software has also facilitated collaboration among designers and engineers, allowing for more efficient communication and problem-solving.

Advancements in materials science and engineering have also had a significant impact on design (Vijay D., 2000, P.27). With the development of new materials and manufacturing processes, designers can create products that are stronger, lighter, and more durable than ever before. For example, the use of composite materials has revolutionized the aerospace industry, allowing for the creation of aircraft that are lighter and more fuel-efficient. Similarly, advances in nanotechnology have led to the development of new materials with unique properties, such as self-healing and self-cleaning capabilities. These materials have opened up new possibilities for designers in various fields, from architecture to fashion.

The invention of 3D printing technology has also transformed the design landscape. With 3D printing, designers can create physical prototypes of their designs quickly and easily, allowing for more efficient testing and iteration. This technology has also enabled designers to create complex geometries that would be difficult or impossible to produce using traditional manufacturing methods. 3D printing has been used in various fields, from product design to medicine, and has opened up new possibilities for customization and personalization. As the technology continues to advance, it is expected to have an even greater impact on the design industry, enabling designers to create more sustainable and innovative products (Vijay D., 2000, P.27).

Science and technology have had a significant impact on design industries, streamlining design processes, and reducing costs. With the advent of computer-aided design (CAD) software, designers can create and modify designs quickly and easily, reducing the time and resources needed for traditional design methods. This has led to increased efficiency in the design process, allowing designers to focus more on creativity and innovation. Additionally, the use of digital tools in design has allowed for greater collaboration between designers, engineers, and other stakeholders, further streamlining the design process.

One of the most significant achievements of science and technology in design is the ability to enable greater precision in design. With the use of advanced measurement tools and software, designers can create highly accurate and intricate

designs that were previously impossible to achieve. This precision has led to improvements in product quality, as well as increased safety in industries such as aerospace and automotive. Furthermore, the ability to create precise and detailed designs has opened up new possibilities for design innovation, allowing designers to push the boundaries of what is possible.

Another way in which science and technology have impacted design industries is by facilitating customization and personalization of products (Omura G., 2021, P.293). With the use of digital technologies, designers can create unique and personalized products tailored to the specific needs and preferences of individual customers. This has led to increased customer satisfaction and loyalty, as well as greater brand differentiation for companies. Additionally, the ability to customize products has opened up new markets for design industries, allowing designers to cater to niche markets and create products that meet specific needs and preferences. Bullet Points: - Computer-aided design (CAD) software has streamlined design processes and reduced costs. - Digital tools have allowed for greater collaboration and efficiency in the design process. - Advanced measurement tools and software have enabled greater precision in design. - Precision in design has led to improvements in product quality and safety. - Customization and personalization of products have been facilitated by digital technologies. - Customized products have led to increased customer satisfaction and loyalty. - Customization has opened up new markets for design industries.

One of the most significant achievements in science and technology that is poised to revolutionize the field of design is the integration of artificial intelligence (AI) into design processes (Omura G., 2021, P.293). AI has the potential to automate and streamline many aspects of the design process, from ideation to production. By leveraging AI algorithms and machine learning, designers can gain new insights into consumer behavior, market trends, and design preferences, enabling them to create more personalized and effective designs. Additionally, AI can help designers optimize their work processes, reducing the time and resources required to bring a product to market.

Another area of significant achievement in science and technology that is shaping the future of design is the exploration of sustainable materials and practices (Vijay D., 2000, P.27). As environmental concerns continue to grow, designers are looking for ways to reduce their environmental impact and create more sustainable products. This has led to the development of new materials and manufacturing processes that minimize waste, reduce energy consumption, and use renewable resources. By incorporating sustainable materials and practices into their designs, designers can create products that are not only more environmentally friendly but also more cost-effective and appealing to consumers.

The development of new technologies and innovations for design applications is another area of significant achievement in science and technology that is transforming the field of design. From 3D printing to virtual reality, designers now have access to a wide range of tools and technologies that enable them to create more complex and sophisticated designs. These technologies also allow designers to collaborate more effectively with clients and stakeholders, enabling them to iterate and refine designs more quickly and efficiently. As technology continues to evolve, designers can expect to see even more exciting and innovative tools and applications emerge, further expanding the possibilities of design.

In conclusion, the significant achievements in science and technology have revolutionized the design industry. The development of computer-aided design software, advancements in materials science and engineering, and the invention of 3D printing technology have all contributed to streamlining design processes, enabling greater precision, and facilitating customization and personalization of products. These advancements have also reduced costs and increased efficiency in the design industry. Looking towards the future, the integration of artificial intelligence into design processes, exploration of sustainable materials and practices, and the development of new technologies and innovations for design applications hold great promise for the future of design. Overall, science and technology will continue to shape and transform the design industry in the coming years.

References:

1. George, Omura (2021), Mastering AutoCAD 2021 and AutoCAD LT 2021 2nd Edition Wiley Publishing, Inc. P. 293
2. Duggal, Vijay (2000). Cadd Primer: A General Guide to Computer Aided Design and Drafting-CADD, Mailmax Publishing, P. 27

MODERN TECHNOLOGIES IN ARCHITECTURE AND PLANNING

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Technologies play important role in modern architectural process. They allow architects to influence building design, effectively and accurately reflect their ideas and ensure safety and sustainability. Innovative and sustainable facilities, created with the help of modern technologies, are designed to meet the needs of modern society.

There are two important stages for architects: planning and layout.

One of the most significant advancements in architectural technology is computer-aided design (CAD). CAD software allows architects to create detailed and precise digital models of their designs. This speeds up the design process and enables architects to visualize their ideas more effectively. Autodesk's software is currently the most popular and largest in the architectural world. It includes such programs as Revit 3D Max, ArchiCad and others. Lira is popular among other developers. This program is used in particular for the development of building structures. There are also fewer professional programs. Among their shortcomings, the choice of interior, exterior or structural elements is limited, however, in such programs as Revit, the user can independently create elements from the smallest to the largest, as well as load different components.

With virtual reality (VR) headsets, architects can immerse themselves in a virtual representation of their designs. Additionally, VR allows clients and architects

see constructions that do not yet exist.

Building information model (BIM) software allows architects to create comprehensive digital representations of buildings, including every detail from floor plans to electrical systems. This collaborative approach brings together various professionals involved in a project, such as engineers and contractors, ensuring better coordination and reducing errors during construction.

Generally, architects can use specialized software to analyse the environmental impact of their designs at each stage of the project. This includes assessing factors such as energy consumption, material selection and waste management. By integrating sustainability into their designs from the start, architects can create buildings that are energy-efficient, economic and environmentally friendly.

Modelling is an integral part of architecture. It also helps in correcting errors and contacting customers. Currently, such modern technologies are used in the layout which perform various functions.

For example, plotter cutting is the process of cutting out images on self-adhesive material. Milling helps to quickly produce complex surfaces on various materials. Rapid prototyping technology is also used for the most accurate execution of the layout. It is divided into many subspecies. When using scrap technology in making a model, layers of objects are created by laminating a sheet of paper. The contour of the layer is cut with a laser (Kozhukhovskiy, 2013, p.305-311). Also, architects often use the technology of casting according to molten models and engraving. The most famous modern means of modelling is a 3D printer. The basis for 3D printing is the BIM digital model of the building.

Therefore, smart technologies help a lot in the profession of an architect. They save much time because the machine will draw perfect lines or correct mistakes easier and faster. Also, if an error is appeared on stage of designing, fixing it will be cheaper and safer. So, new technologies and programs establish communication between architects, engineers, managers, builders and clients.

References

1. Kozhukhovskiy A. N. Application of modern innovative technologies in the process of making an architectural model. Scientific bulletin of the National Forestry

University of Ukraine, 23.18, 2013, p. 305-311.
http://nbuv.gov.ua/UJRN/nvnltu_2013_23.18_50

2. The Diplomatic Insight. Role of Technology in Modern Architecture. 2020.
<https://thediomaticinsight.com/role-of-technology-in-modern-architecture/>

RENEWABLES

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Renewable energy plays a crucial role in the transition to zero-carbon energy. Understanding the current role of renewable energy sources in the decarbonization of various sectors is key to ensuring a smooth path to net-zero (Global Energy Review (2021) p. 2).

One of the most promising developments is in the field of perovskite solar cells. These cells have seen a pivotal breakthrough, which could have significant implications for renewable energy. The evolution of perovskite solar cells represents a huge step forward in harnessing solar power more efficiently.

Another exciting development is the use of artificial intelligence (AI) algorithms for controlling the heating and cooling of office buildings. These systems do not require ambient sensors or specific knowledge of the building's rooms, making them highly adaptable and efficient.

According to the International Energy Agency's Global Energy Review 2021, renewable energy use grew by 3% in 2020, while demand for all other fuels fell. The main driver was almost a 7% increase in renewable electricity generation. (Renewables 2021)

Renewable electricity generation in 2021 is expected to increase by more than 8% and reach 8,300 TWh, marking the fastest annual growth since the 1970s. Solar photovoltaics and wind power are expected to make up two-thirds of renewable growth. (Renewables 2021)

In 2021, China alone is expected to account for almost half of the global increase in renewable electricity generation, followed by the United States, the European Union, and India. (Renewables 2021)

References:

1. Global Energy Review (2021) – Analysis - IEA
2. Renewables 2021 – Analysis - IEA - International Energy Agency. Retrieved from <https://www.iea.org/reports/global-energy-review-2021/renewables>

RENEWABLES

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From the very beginning of the full-scale military aggression by the Russian Federation against Ukraine, the objects of our country's energy infrastructure were and remain one of the main targets for the enemy army. At first, these were oil refineries, oil product storage facilities, power plants and substations supplying the railway, and now - critical energy facilities.

Renewable energy sources (RES) are such sources that are renewed naturally. Renewable energy (also renewable energy) is an energy industry specializing in obtaining and using energy from renewable energy sources. Renewable energy sources include periodic or steady flows of energy distributed in nature and limited only by the stability of the Earth as a cosmoplanetary element: radiant energy of the Sun, wind, hydropower, natural thermal energy, etc.

Renewable energy sources are able to renew themselves. Such renewal occurs naturally. Renewable energy sources include, in particular, solar energy, wind and water energy, organic biomass, etc.

The regular and purposeful destruction of Ukraine's energy infrastructure has caused emergency and stabilizing power outages, street lighting shutdowns, restrictions on subway and trolleybus traffic, and energy consumption by industrial enterprises.

The war in Ukraine has also had a major impact on global energy markets, leading to price volatility, supply shortages, security concerns and economic uncertainty – all of which the International Energy Agency (IEA) has already called “the first truly global energy crisis”.

The production of renewable energy produces far fewer emissions, so the transition from fossil fuels to renewable energy sources is considered the key to overcoming the climate crisis.

In addition, the use of renewable energy can help reduce the cost of electricity, contribute to a fault-tolerant electricity grid, create jobs and stimulate economic growth, generate back-up energy for outages combined with its storage, and operate with equal efficiency in both small and on a large scale.

Renewable energy sources are numerous and surround us everywhere. Currently, the most popular among them are:

- solar energy;
- wind energy;
- hydropower;
- tidal energy;
- geothermal energy;
- biomass energy.

And the use of renewable energy sources contributes to the sustainable development of cities, which, thanks to solar, wind, biogas installations, and small hydroelectric power plants, can provide themselves with electricity, reducing their costs and resource dependence. The population can independently generate electricity and control its distribution, while also minimizing long-distance transmission losses. This, in turn, reduces the burden on nature and makes it possible to talk about economic growth, which today is restrained by the extensive traditional energy we are used to. Every year, “green” energy becomes more accessible, new sources and production technologies are invented, which undoubtedly contributes to the development of innovations and improvement of infrastructure, stimulates the development of education and science.

The transition to inexhaustible sources of energy contributes to the preservation of peace on earth, because, apparently, one of the main causes of wars is the struggle for resources, including energy resources. And in this case, there is no point in fighting for what is already in abundance: sun, wind, water...

Indeed, renewable energy is almost as key as the eradication of poverty, hunger and inequality, the goal of humanity, which is planned to be achieved by 2030.

The development of the “green” industry is particularly important for us. An industry capable of making every city and village, every citizen, more independent. So that there would be no war and Ukrainians would not die. So that there is no constant plea from the TV screens of sick children who need money for treatment. So that cancer and many other diseases do not reduce the quality and life expectancy of Ukrainians. So that the payment for light and heat does not constitute the meaning of our existence.

References:

1. *Types of renewable energy*. European.

https://euopan.ua/news/?gclid=CjwKCAjwkY2qBhBDEiwAoQXK5bPasHLT5S-8R6y0UDwyQhbjxztaAJN0TxQ2ad_sgYkXeAAmisLhTBoCSf8QAvD_BwE

2. *Renewable energy*. European.

https://euopan.ua/news/?gclid=CjwKCAjwkY2qBhBDEiwAoQXK5bPasHLT5S-8R6y0UDwyQhbjxztaAJN0TxQ2ad-sgYkXeAAmisLhTBoCSf8QAvD_BwE

FIGHT AGAINST GLOBAL WARMING

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The problem of global warming is probably the most important problem nowadays. Enormous amount of carbon dioxide is being released into the atmosphere by cars, factories, big corporations. Because of greenhouse gases in the planet’s atmosphere cause the heat radiate from the planet’s surface, which causes increasing

the temperature of our planet. Greenhouse gases are mostly consisting of carbon dioxide, methane, ozone, and of course water vapor. Greenhouse effect causes melting icebergs, which causes the rising of ocean level. Also, nowadays more often the temperature records are observed and the global warming is the main reason of this.

These days people are becoming more conscious in ecological situation and are trying to improve it. For example, more and more people are replacing their vehicles with gasoline or diesel engines with far more eco-friendly electric cars. People are using the electricity from solar panels instead of electricity from thermal power plans, where the electricity is produced by burning gigantic amount of coal, smoke from which is going to the atmosphere. Also, a lot of countries are abandoning the production of electricity in nuclear and thermal power plants in favor of solar, wind and hydroelectric power plants.

I think that people do a lot of things to prevent the increasing of global warming. However, I think that this is not enough. People have got to use far more electricity from solar, wind and hydroelectric power plants. Also, countries should raise the prices for gasoline and diesel fuel to make driving the electric cars way cheaper and more affordable. I think that if all people will care about the ecology of our planet, then we will be able to save our Earth.

Reference

“Solar Radiation and the Earth's Energy Balance”. The Climate System – EESC 2100 Spring 2007. Columbia University. Archived from the original on 4 November 2004. Retrieved from https://en.m.wikipedia.org/wiki/Greenhouse_effect

GLOBAL WARMING

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Global warming has resulted in increased ocean temperatures, leading to the bleaching of coral reefs and the disruption of marine ecosystems. This phenomenon not only threatens the survival of diverse marine species but also impacts the livelihoods of communities dependent on marine resources, thereby posing a significant socio-economic challenge.

The escalating global temperatures have accelerated the melting of polar ice caps and permafrost, contributing to rising sea levels and the release of trapped methane. The release of methane, a potent greenhouse gas, further exacerbates global warming, creating a feedback loop that intensifies the overall warming trend and poses a long-term threat to the stability of the planet's climate.

Global warming has adverse implications for agricultural productivity, as it leads to shifts in growing seasons, increased prevalence of pests and diseases, and water scarcity in many regions. These factors collectively contribute to reduced crop yields, threatening global food security and exacerbating the challenges faced by vulnerable communities and regions already grappling with hunger and malnutrition.

The impacts of global warming extend to human health, with the warming climate facilitating the spread of vector-borne diseases such as malaria, dengue fever, and Lyme disease. Additionally, heatwaves and extreme temperatures pose direct health risks, particularly to vulnerable populations, amplifying the prevalence of heat-related illnesses and placing additional strain on healthcare systems and infrastructure, particularly in developing countries.

Global warming poses an ethical dilemma, as the decisions made today have far-reaching consequences for future generations. Failing to mitigate and adapt to the effects of global warming not only undermines the well-being and opportunities of future generations but also reflects a disregard for the preservation of the planet's natural resources and biodiversity, highlighting the urgent need for collective action and sustainable solutions to address this global challenge.

References:

1. Roser, D. (2023, January 17). Intergenerational ethics. [Electronic resource] *Encyclopedia Britannica*. Retrieved from

<https://www.britannica.com/topic/intergenerational-ethics>

2. Fabio-Massimo, B. (2023, March 30). Climate Change and the Ocean: The Disruption of the Coral Reef. *Springer Link*. Retrieved from https://link.springer.com/chapter/10.1007/978-3-031-24888-7_10

TECHNOLOGICAL BREAKTHROUGHS: THE PAST, PRESENT AND FUTURE

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Throughout history, there have been significant technological breakthroughs that have shaped the world we live in today. One remarkable example is the invention of the printing press in the 15th century by Johannes Gutenberg. This invention revolutionized communication by making books and information more accessible to a broader audience. Similarly, the development of the steam engine during the 18th century marked the beginning of the Industrial Revolution. This innovation powered machinery and transportation, transforming the way we work and travel. These past technological breakthroughs set the stage for the modern world we know today.

We are currently experiencing a new wave of technological breakthroughs that are significantly impacting our daily lives. One of the most noticeable innovations is artificial intelligence (AI). AI is being used in various applications, from voice assistants in our smartphones to advanced algorithms in healthcare. Renewable energy sources, such as solar and wind power, are also making strides. They are helping to reduce our reliance on fossil fuels and combat climate change. These present-day technological breakthroughs are enhancing our productivity, communication, and sustainability.

The future holds the promise of even more exciting technological breakthroughs. Autonomous vehicles, or self-driving cars, are being developed and tested. These vehicles have the potential to make transportation safer and more

efficient. In the field of healthcare, technology is advancing rapidly, leading to better diagnosis and treatment options. Moreover, the integration of AI into our daily lives will bring new conveniences, from smart homes to improved education. These future innovations will continue to change the way we live, work, and interact with the world.

Throughout history, technological breakthroughs have been crucial in shaping the course of human civilization. They have solved problems, created new opportunities, and improved the quality of life. In the past, they led to the Industrial Revolution and the spread of knowledge through the printing press. Today, they're driving our digital age with AI and renewable energy. As we look to the future, we can expect these breakthroughs to continue enhancing our lives, making the world more connected, efficient, and sustainable. Technology remains a driving force in our history and will remain so in the future.

References:

1. Smith, A. (2019). The Impact of Artificial Intelligence on Healthcare. Retrieved from: <https://www.nature.com/articles/s41746-019-0191-0>
2. Green Energy Association. (2020). Advancements in Renewable Energy. Retrieved from: <https://www.mdpi.com/1996-1073/13/19/5229>
3. Johnson, E. (2021). The Future of Autonomous Vehicles. Transportation Technologies Today. Retrieved from: <https://www.sciencedirect.com/science/article/pii/S1361920921000225>

PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Artificial intelligence (AI) already affects many aspects of our lives and has enormous potential for further development. The prospects of AI are now considered as one of the key areas of technological development.

Artificial intelligence is already being used in industry to automate production, from monitoring equipment to solving strategic production management tasks. This can lead to the increased productivity and lower costs. It helps to develop new methods of diagnosis and treatment of diseases, as well as to predict epidemics. The ability to analyze huge medical data makes medicine more efficient and accessible. It is also already being implemented in the automotive industry to create autonomous cars, which can improve road safety and reduce the number of accidents. In the banking sector, AI is used to analyze markets, predict currency rates, detect and combat fraud. It helps to create individual training programs as well as develop effective methods of assessment and support for students. In the gaming industry, artificial intelligence is used to create realistic virtual worlds and intelligent enemies. AI is being developed to improve speech recognition and voice interaction with computers, which can make it easier to interact with technology. Using artificial intelligence to monitor the environment allows you to fight pollution and save natural resources. The development of artificial intelligence requires solving ethical issues related to its application and impact on society, as well as ensuring data security and protection. In the future, the development of AI that is capable of self-learning and improving its capabilities is possible, which opens up a wide range of opportunities and challenges.

Today, thanks to the rapid development of technology, even ordinary coffee preparation can be taken to a whole new level thanks to artificial intelligence. Modern coffee machines do not just prepare drinks, they have become real assistants for coffee lovers, which allows you to enjoy delicious coffee drinks every day without extra effort.

One of the key advantages of such machines is their ability to adapt to the individual tastes of each user. Thanks to the built-in artificial intelligence system, coffee machines can take into account settings such as coffee strength and volume, temperature, degree of roasting of coffee beans, and even take into account the user's previous choices. They learn our preferences and can create perfect recipes that match exactly our taste.

In addition, thanks to built-in sensors and the ability to analyze the quality of water and coffee beans, these machines ensure the optimal quality of the drink. They can even remove imperfections if the quality of the water or other ingredients is not ideal.

Another interesting possibility is the possibility of remote control. Wherever you are, you can turn on your coffee machine using your smartphone or voice assistant. This allows you to prepare coffee immediately before coming home or even prepare it from bed.



Drawing 1

Modern coffee machines with artificial intelligence facilitate the preparation of coffee, making it more convenient and individual. They help to enjoy a refined coffee experience without unnecessary hassles and thus become an integral part of our daily life.

In general, artificial intelligence has the potential to affect many areas of life and expand the possibilities of humanity, but also needs attention to the ethical and security aspects of its use.

Reference:

How does a coffee machine work? (2013) Coffee makers. Retrieved from: <https://www.goodreads.com/book/show/41741390-coffee-makers-machine-da-caff#CommunityReviews>

ENERGY EFFICIENCY OF LED LIGHTING USAGE

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One of the primary directions in municipal energy management involves the implementation of modern and more efficient lighting sources. In Ukraine, a

significant portion of electricity, approximately 15% or 27 billion kilowatt-hours per year, is consumed for lighting purposes. This is in line with the situation in developed countries, but the efficiency of its utilization is quite low. Annual lighting expenses in Ukraine amount to approximately 42 million kilowatt-hours per person, compared to 100-110 million kilowatt-hours per person in the United States. This issue arises due to the substantial use of inefficient lighting sources such as incandescent lamps, constituting 35% of the total amount, as opposed to 20% in Western countries. Additionally, there is a low adoption of energy-efficient semiconductor lighting sources in the public and administrative building sectors. Semiconductor light sources and LED panels represent promising alternatives to traditional thermal and discharge lamps.

LEDs have a robust potential in the field of lighting. Recent research has demonstrated that LEDs have achieved record-breaking levels of luminous efficiency, up to 276 lm/W for laboratory samples and approximately 200 lm/W for commercial models. This signifies the high level of sophistication in their design. Additionally, it is essential to highlight the extended service life of LEDs, ranging from 25,000 to 50,000 hours, characterized by a decrease in light output to 70-50% of the nominal value. While semiconductor light sources may be more expensive, they offer numerous advantages, including high brightness, compactness, ease of light output adjustment, and the ability to create various stylistic solutions. Every year, the growth of energy production and consumption in the world creates the necessary conditions for accelerating scientific and technical progress and improving the well-being of the people of the planet. At the same time, the increase in energy consumption requires more and more hydrocarbon raw materials, the reserves of which are unlimited. The main factor contributing to the need for energy saving is the depletion of fossil fuel reserves. As a result, oil and gas prices can be expected to rise steadily in the future. The solution to this problem involves a strict energy-saving policy based on the use of energy-saving technologies, nuclear power, alternative energy sources, and, above all, renewable ones, which include solar, wind and geothermal energy, biomass, small and large hydropower, and ocean energy.

With the ongoing technological advancements in semiconductor lighting sources and their decreasing costs, the adoption of LED lighting is becoming increasingly relevant. Significant energy savings, amounting to approximately \$7,000 per year, can be achieved through the use of LEDs. The extended service life of LEDs will spare consumers from additional expenses associated with lamp replacements. Companies such as Philips and General Electric manufacture LEDs designed to operate for at least 7 years, fully paying off their initial costs within about one and a half years. The economic benefits derived from replacing old lighting sources with LEDs demonstrate that the investments in lighting modernization are justified and lead to substantial energy resource savings. Energy-saving technologies include new or improved technological processes characterized by a higher coefficient of useful use of fuel and energy resources. With the aim of conserving electrical energy consumed for lighting, LED light sources and lighting systems based on them are being implemented. This includes the utilization of imported semiconductor plates with LED technology (Bukharin, 2011).

In conclusion, it can be emphasized that LEDs are promising lighting sources with numerous advantages, representing the potential for creating efficient and modern lighting systems. Specifically:

1. LEDs can operate effectively at low temperatures, making them particularly relevant in our climatic conditions, with an operating temperature range from -50 to +60 degrees Celsius.
2. High luminous efficiency of LEDs, with brightness reaching up to 130 lm/W in commercial production and up to 200 lm/W in laboratory conditions, significantly surpassing conventional incandescent lamps, which provide only 10 lm/W, marking a substantial improvement.
3. LEDs enable the generation of various colors and shades of light emission, including pure blue, white, warm white, blue-green, and many other colors that cannot be achieved using incandescent lamps.

4. High safety is ensured when using LEDs due to low heat generation and low operating voltage, allowing their use in various specialized conditions, including wet environments and facilities with high safety requirements.
5. LEDs have directional light emission, and various modifications with different light dispersion angles are available, allowing for the creation of efficient lighting systems without the need for additional reflectors or diffusers.
6. It is essential to note that LEDs do not contain mercury or other toxic substances, making them environmentally safe.

Overall, the implementation of LED lighting can significantly reduce electricity costs and contribute to the development of more energy-efficient lighting systems.

References

1. Bukharin, S. L. (2011). Methodological Guidelines: *Special Light Sources*. The digital repository of Kharkiv National University of Municipal Economy named after O.M. Beketov. 68p.
2. Weiner, J. (Author), & Spalding, C. (Illustrator). (2004). *LED Lighting: Principles of Operation, Advantages, and Applications*. LLC "Light Technologies" 146p.

HOW TO REVERSE GLOBAL WARMING

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Global warming is an observable fact; it does not depend on the opinion of scientists or politicians. Just look at the dynamics of the average annual temperature on the planet.

Over the past hundreds of years, the temperature on the planet has risen by only 1°C. It seems to us that this is quite a bit. This causes public concern and force the governments of developed countries to impose restrictions on dirty industries.

From year to year, the climate on Earth is changing for the worse and this is

becoming a problem for mankind (An Information Statement of the American Meteorological Society, 2019). The change in the global climate is proved by various scientific works. There are constant discussions and disputes around this phenomenon. Many scientists call this process "global warming". Others think it will lead to global cooling.

The evidence for climate change is there and familiar to most of us: an increase in the amount of water in the ocean, which is associated with the melting of glaciers that release huge amounts of water, floods in Eurasia and droughts in Africa.

Global warming is already affecting most of the animal species that live on our planet. Polar bears and penguins will move away from their habitats to a colder place. A lot of species of animals, insects, and plants will disappear altogether. Hundreds of millions of years ago, warming destroyed almost the entire globe.

According to the forecasts of a large number of scientists, global warming can provoke a cooling all over the planet. In the 19th century, volcanic eruptions were the cause of the cooling, but now this can provoke the melting of glaciers and an increase in the level of the world ocean (Climate Change (2014) Synthesis Report Summary for Policymakers, 2014).

The initiative to create a new research center is coordinated by Professor David King, a former scientific adviser to the British government. Scientists proceed from the fact that the measures proposed now will not be able to prevent dangerous and irreversible climate change on the planet.

One of the most promising ideas is a project to increase the reflectivity of clouds over the poles of the planet. To this end, it is proposed to spray seawater with powerful hydrants installed on automatic vessels in polar waters. Thus, micro droplets of saline solution will appear in the air, which will form a cloud with a higher albedo or reflectivity, and thus cool the water and air in its shadow.

Another new approach is a variant of the well-known concept of carbon dioxide extraction or sequestration from the atmosphere. It involves intercepting carbon dioxide emissions from coal or gas thermal power plants or steel mills and burying them underground.

Another proposal that the new center will consider is seeding the oceans with live algae in order to increase the absorption of carbon dioxide. Such a scheme involves spraying powdered iron over the ocean, which stimulates the growth of phytoplankton. Previous experiments have shown that the growth of algae does not lead to a sufficient increase in the amount of CO₂ absorbed and may even lead to disturbances in the ecosystem.

In conclusion, I believe that if we simply reduce the level of greenhouse gas emissions into the atmosphere, we will only achieve that global warming will slow down. And this is bad, because now the average temperature of the planet is too high and we already have too much carbon dioxide in the atmosphere. Therefore, I think that geoengineering projects can lead to more active removal of greenhouse gases from the atmosphere. People are able to reduce CO₂ levels below what exists now and cool the climate to the level that existed before the industrial era.

References:

1. An Information Statement of the American Meteorological Society (2019) *American Meteorological Society*. Retrieved from <https://www.ametsoc.org>
2. Climate Change (2014) Synthesis Report Summary for Policymakers. *The Intergovernmental Panel on Climate Change*. Retrieved from <https://www.ipcc.ch>

PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Printing machines serve as the backbone of the printing process. This section will discuss the fundamental functions of printing machines, which include supplying printing materials, transferring printed matter, facilitating drying, and ensuring the accurate registration of images. Understanding these functions is crucial for comprehending the importance of the device's properties.

The properties of printing devices, especially the characteristics of the

cylinders involved in the printing process, are of paramount importance. We will delve into the specifics of these properties, emphasizing factors like surface quality, cylindrical shape, and tolerances. Additionally, we will highlight the industry standards and guidelines regarding these properties.

The interaction between printing materials, cylinders, and ink pressure is a critical determinant of print quality. We will explore how the properties of printing devices affect ink transfer, image sharpness, color consistency, and overall print quality. Real-world examples and case studies will be provided to illustrate these concepts.

To enhance print quality and efficiency, it is essential to optimize the properties of printing devices. This section will discuss techniques and strategies for achieving the desired properties, with a focus on maintaining small surface irregularities and tolerances, such as the recommended 0.0125 mm limit on total beating.

In conclusion, the properties of printing devices are pivotal in ensuring high-quality prints and efficient printing processes. A thorough understanding of the role of printing machines and the impact of cylinder properties is vital for professionals in the printing industry. By optimizing these properties, printers can achieve improved print quality, consistency, and cost-effectiveness, leading to greater customer satisfaction and competitiveness in the market.

References:

1. Prospects for the development of AI (Artificial Intelligence) (2023)
<https://termobud.com.ua/ua/news/perspektivi-razvitiya-ii.html>
2. How artificial intelligence works and prospects for its use
<https://aiconference.com.ua/uk/news/printsipi-raboti-iskusstvennogo-intellekta-i-perspektiva-ego-ispolzovaniya-92238>

ROBOTIC INTEGRATION IN OUR LIVES

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Integrating robots into our lives: impact, benefits and challenges

With the development of technology and rapid changes in our society, significant changes are taking place in various aspects of life. One such significant transformation is the integration of robots into our everyday and professional life. Robots are becoming increasingly important in many fields, from manufacturing and medicine to education, and entertainment. In this article, we will consider the impact of the integration of robots on modern society, the advantages and challenges associated with this trend.

The impact of the integration of robots on the work environment

First of all, it is important to consider the impact of robots on the work environment. The integration of robots into production has led to the automation of many tasks and the reduction of manual labor. This allows you to increase productivity, reduce costs, and improve production quality. However, this automation can also lead to job losses and the need to retrain workers to work with robots and automated systems.

Impact of robots on healthcare

Robots have long been used in the field of medicine. Surgical robots help doctors perform operations with greater precision and less risk to patients. Robots are also used to deliver medical supplies and provide medical advice remotely. This improves the availability of medical care and makes it more efficient.

Jobs in education

Education is another field where robots are starting to take their place. Robots can be used to automate administrative tasks in educational institutions, as well as to provide individual support to students. AI platforms can create personalized learning programs for each student, improving the quality of education.

Jobs in the service sector

The service sector is also affected by robots. For example, in the hotel business, robots can receive guests, provide information about the hotel and the

surrounding area, and deliver services to rooms. In the restaurant industry, robots can prepare food and serve customers. This can make the work of staff easier and improve customer service.

Challenges of robot integration

While robot integration has many benefits, it also presents some challenges. First, there is the issue of data security and privacy when using robots, especially in the healthcare and financial services industries. It is also important to consider the moral aspects of using robots, particularly in areas where they can replace humans.

In addition, the integration of robots may lead to job losses in industries where robots can replace humans. This can lead to social problems such as unemployment and income inequality. It is important to have strategies to retrain workers and create new jobs in areas where people remain indispensable.

Advantages of robot integration

The integration of robots also has numerous advantages. It can increase productivity, reduce costs, and improve the quality of products and services. Robots are resistant to fatigue and errors, which allows them to work continuously and precisely. They can perform tasks in conditions inaccessible to humans, for example, in hard-to-reach places or in dangerous conditions.

The future of robot integration

The future of robot integration promises many exciting possibilities. The development of artificial intelligence and robotics will lead to the creation of more intelligent and autonomous robots. This will open new horizons in fields such as autonomous cars, Mars missions, and many others. The growing popularity of robots in everyday life and in education will also lead to the emergence of new opportunities and innovations.

Conclusion

The integration of robots into our lives opens up many opportunities, but it also presents us with challenges. It is important to carefully study this process, develop rules and regulations for the use of robots in various industries, and develop strategies for the future. The benefits of integrating robots can be a great contribution to our

society if we understand and manage their impact in the right way.

Reference

Development of robotics: the future has already arrived. (2021, November 8). Retrieved from <https://metinvest-smc.com/ua/articles/razvitie-robototexniki-budushee-uzhe-nastupilo/>

ADVANCEMENT IN ADDRESSING ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Scientific and technological progress is developing rapidly every day, which directly affects our lives. This text provides an overview of significant advances in modern environmental science with emphasis on environmental issues related to water resources.

In Ukraine, there is an extensive network of rivers, lakes, seas and reservoirs. They have an important role in agriculture, industry, ecosystem and human well-being. Water resources face many ecological challenges. Inadequate treatment of wastewater and sewerage discharges from enterprises, uncontrolled agricultural discharges lead to pollution of waters in Ukraine (Romanenko, 1999). Toxic chemicals, pesticides, radioactive metals, etc. negatively affect the quality of water and aquatic flora. Negative consequences of global warming and climate change cause changes in the type and amount of precipitation, increases in average annual temperatures and an increase of natural disasters. These changes affect water availability and quality (Osadchy, 2017).

The latest scientific developments, such as Internet of Things (IoT) sensors and GIS (Geographic Information System) help scientists monitor water quality in real time in various bodies of water. Modern technologies are used to collect large volumes of data on various parameters of the Ukrainian aquatic environmental

pollutants. The usage of this data enables the relevant authorities to respond to cases of local pollution. The introduction of the latest developments in the field of satellite remote sensing makes it possible to collect and analyze data on the state of qualities, such as turbidity, blooms, uncontrolled spread of algae and chlorophyll concentration. Modern advances in the technologies of remote sensing include high-altitude imaging of large water bodies in a variety of spectra. The use of sensing allows the monitoring of large areas and identification of sources of pollution and the spread of environmental changes. Postolache (2019) mentions *Internet of Things (IoT) sensors*. Such sensors are placed in bodies of water to measure water parameters. (IoT) sensors are used to monitor pH, the amount of oxygen and hydrogen in water, turbidity, etc. Data from sensors is transmitted to central databases for processing and thorough analysis via mobile Internet.

Geographic Information System (GIS) technology allows inclusion of geospatial data directly related to water quality. It helps in mapping and visualising the distribution of pollutants, water quality parameters, and contamination sources. Combining GIS with other data sources provides a clear understanding of water quality issues. Online monitoring has crucial value for early warning systems. These systems detect sudden changes in water quality. In case of intensive increase in a pollution level or a harmful algal bloom, the system activates alerts, allowing authorities to respond and prevent further contamination. This allows for the quick detection of anomalies and pollution events (Postolache, 2019).

Eco-Friendly Technologies play an important part in Constructed Wetlands and Bioremediation. Constructed wetlands are engineered systems that mimic natural wetlands and use plants and microorganisms to treat wastewater, which is environmentally friendly and energy-efficient. Bioremediation technology is the usage of living microorganisms to purify and naturally normalize contaminated water.

Water treatment facilities need to widely utilise and integrate renewable energy sources as well as solar and wind energy for water facilities into their operations. It helps to reduce carbon emissions and fossil fuels. Usage of renewable energy sources

will reduce the operating costs of facilities and the rate of global warming.

Preserving the quality and of Ukraine's water resources, solving environmental problems is very important for protecting human health, development of the state and reducing the consequences of climate change. The significance of these efforts can be summarised as follows:

Environmental Protection: Protecting water bodies is critical to maintaining a healthy ecosystem. Smart technologies help identify sources of pollution and make environmental protection measures more effective. Public Health: Quality drinking water is a vital factor for human health. Free real time access to information of the drinking water protects the country's population health. Water Source Management helps in efficiently distributing limited amounts of water for various purposes. (Aini, 2001). Research and Policy Development: Continuous monitoring of data of water resources quality is the basis for research and development of agendas, rules and environmental policies of the state. Prompt response to contamination incidents: Real-time monitoring of pollution incidents allows to react rapidly, what can reduce the environmental and economic impact of contamination. Development: Proper management of water resources contributes to food security, the economic growth and improved human well-being.

References:

1. Romanenko V. D., Zhukynskii V. M., Oksiyuk O. P. at al. (1999) [Methodology of ecological assessment of the quality of surface water according to respective categories]. Kyiv, Simvol-T.
2. Osadchyi V. I. *Resources and quality of surface water in Ukraine under conditions of anthropogenic load and climate change (According to the materials of scientific report at the meeting of the Presidium of NAS of Ukraine, May 31, 2017)*. (2017). Visnyk NAN Ukrainy, 2017, No. 8. pp. 29-46. [in Ukrainian].
3. Postolache, O. A., Sazonov, E., & Mukhopadhyay, S. C. (Eds.) (2019). *Sensors in the age of the Internet of things: technologies and applications*. (IET Control, Robotics and Sensors Series; Vol. 122). The Institution of Engineering and Technology (IET). <https://doi.org/10.1049/PBCE122E>

4. Aini, M. S., A. Fakhru'l-Razi, A., & Suan, K. S. (2001). Water Crisis Management: Satisfaction Level, Effect and Coping of the Consumers, Springer; European Water Resources Association (EWRA), vol. 15(1), pages 31-39. <https://doi.org/10.17226/11031>

SMART TECHNOLOGIES IN SCIENCE AND ART

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Various smart technologies have become a part of our daily life and development in various fields such as medicine, construction, education, cinematography, art, etc. for quite some time. A variety of gadgets and programs perform a huge number of tasks, while a person can focus on performing more complex, specific, creative tasks.

One of the areas where the latest technologies can be used is the preservation of the heritage of the past. For example, the creation of completely virtual museums, or the use of augmented reality in simple museums to improve the understanding of exhibits and their addition, as well as Augmented Reality (AR) can be used even in the process of excavations and other archaeological research, to facilitate some steps of research and recovery of already completely lost artifacts, architectural objects and other archaeological finds.

But in addition to the AR mentioned above, there is also mixed reality (MR) technology, which in turn has several differences with AR. The usual example of this technology would be the projection of virtual screens providing information to the user while also seeing the physical space, such as the Google Glass hardware tried to achieve before its untimely death.

The mixed reality, however, combines virtual reality and augmented reality to improve interactivity and the ability to add virtual objects to physical reality, and vice versa to add real objects to virtual reality.

Since the advent of the idea of the virtual museum, the museum community has struggled with a number of controversial aspects such as:

- the question of the aura of the object,
- the question of authenticity and experience,
- the democratization of museums by the new medium,
- the authority of museums,
- trust in virtual museums, and
- the question of whether people will still attend museums when all the content is online. (WERNER SCHWEIBENZ, 2019)

Now most of these problems have been overcome, one of the reasons is the new generation, which is ready to partially combine the virtual and real world and give museums a dual character, both virtual and real.

Museums opened in a new way with the help of smart technologies. With the help of augmented reality and virtual reality, you can hold virtual exhibitions or add interaction with exhibits in a real museum. On the Google Arts & Culture website, you can visit many virtual exhibitions at a time convenient for you.

With this you can visit: The British Museum, London; Guggenheim, New York; National Gallery of Art, Washington, D.C.; Musée d'Orsay, Paris; National Museum of Modern and Contemporary Art, Seoul; Uffizi Gallery, Florence, to name but a few.

Many augmented reality systems can show us many archaeological sites:

- Archeoguide
- Lifeplus
- ARAC Maps (Tommaso, D. P. L., & Mongelli, A. (2015))

Augmented reality allows an alternative way to find important historical monuments by scanning the environment and visualizing it as a virtual object.

Therefore, the development of technology and the further progress of mankind introduce innovations in all possible fields, including the preservation of monuments of history and art of the past and present.

References:

Tommaso, D. P. L., & Mongelli, A. (2015). *Augmented and virtual reality second international conference, AVR 2015, Lecce, Italy, August 31 - September 3, 2015, Proceedings*. Springer International Publishing.

WERNER, W. (2019, August 11). The Virtual Museum: An overview of its origins, concepts, and terminology.

CLIMATIC WARMING ON A GLOBAL SCALE

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For generations, climate scientists have taught the public that “not all weather is the same,” describing climate change as changes in weather patterns that gradually fluctuate widely over decades.

But when you look at weather on a global scale, it’s uncharted territory. Here, we use daily observed global temperature and humidity to detect fingerprints of exogenous climate change and conclude that the entire planet is warming.

Traces of climate change can be seen in the global observational record every day since the beginning of 2012 and every year since 1999. Even ignoring long-term warming trends, the evidence remains conclusive. This not only complements traditional climate change detection, but also opens up a broader perspective on communicating regional weather events and changing climate change narratives. (Sippel, 2020)

Scientists believe that an overheated world will exceed critical temperature limits for the first time in the next few years. Researchers say there is a 66% chance that global warming will exceed the 1.5°C threshold by 2027. The likelihood has increased due to emissions from human activities and the potential for an El Niño event later this year. Scientists stress that if the world exceeds limits, the impact will be worrying, but only temporary. If the limit is exceeded, world temperatures will be 1.5°C warmer than before industrialization really kicked off fossil fuel emissions in

the late 19th century.

The 1.5°C value has become a hallmark of global climate negotiations. In the 2015 Paris Agreement, countries agreed on a “goal” to limit global temperature rise to 1.5°C. If temperatures exceed 1.5°C per year for 10 or 20 consecutive years, the effects of global warming will be greater, including longer heat waves, more severe storms and more wildfires.

But exceeding this level in the coming years does not necessarily mean a violation of the Paris Agreement. Scientists say there is still time to curb global warming by drastically reducing emissions: The World Meteorological Organization (WMO) predicts that global temperatures will exceed 1.5°C in a given year after 2020, with warming expected to be below 20°C within five years. %. That rose to 50% last year and now to 66%. (McGrath, 2023)

Recent statements from the US, EU, China and Russia show that some of the world's largest organizations are formally acknowledging the consequences that the planet will face if we do not commit to change. Indeed, at a recent virtual climate summit of 40 world leaders, the United States pledged to cut greenhouse gas pollution in half by 2030, underscoring how critical this decade will be for decisions to avoid the worst consequences of climate change.

The combined efforts of the world's most influential countries offer great hope for the future of our planet. Despite differences and competition between countries, there is a recognition that climate change transcends these differences and is an issue that requires global engagement. The more we work together, the more we can prioritize our commitment to a sustainable global future and the more aligned the goals of the projects we support become. (Van het Hof, 2021)

References:

1. Sippel S. (2020). *Climate change now detectable from any single day of weather at global scale*. Nature climate change. Retrieved from. <https://www.nature.com/articles/s41558-019-0666-7>

2. McGrath M. (2023). *Global warming set to break key 1.5C limit for first time*. BBC. Retrieved from <https://www.bbc.com/news/science-environment-65602293>
3. Van het Hof W. (2021). *Addressing Climate Change on a Global Scale*. LinkedIn. Retrieved from <https://www.linkedin.com/pulse/addressing-climate-change-global-scale-walter-van-het-hof>

AN ASSESSMENT OF HIGHER ALCOHOL BIOFUEL BLENDS

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Due to concerns over fossil fuel scarcity and environmental pollution, biofuels, especially alcohol-based ones, are gaining traction as viable gasoline substitutes. While ethanol has been a primary focus, recent attention has shifted to higher alcohols (C4-C7) due to their superior energy content and compatibility with gasoline (Ashok et al., 2019, p. 266). This thesis aims to evaluate higher alcohols and their blends to determine the optimal alternatives for spark-ignition (SI) engines.

This research evaluated 18 high-alcohol gasoline blends for SI engines, covering C4-C7 alcohols. Specifically, were studied n-Butanol blends like NB10-NB30 (Ashok et al., 2019 pp. 265-289), iso-Butanol blends IB10-IB30, n-Pentanol blends Pt5-Pt20 (Yaman & Yesilyurt, 2021), and 1-Hexanol and 1-Heptanol blends HEX5-HEX20 and HP5-HP20 (Yaman et al., 2021).

To evaluate SI engine performance with various fuel mixtures, two factors are commonly used: Brake Thermal Efficiency (BTE) and Brake-specific Fuel Consumption (BSFC) (Ashok et al., 2019, p. 267). Additionally, the alcohol content in blends also is an important criterion, as increasing the content can decrease carbon emissions, given that many alcohols can be biosynthesized by capturing CO₂ from the air (Yunus & Jones, 2018, p. 59).

The referenced studies tested blends on single-cylinder, 4-stroke SI engines

with varying modifications, like different compression ratios and engine power. These variations can greatly influence BTE and BSFC, rendering direct data comparisons impractical. In this study, blends were assessed based on their change rates relative to a benchmark fuel (pure gasoline) for each test. This approach allows for dynamic comparisons across different engine modifications. However, (Yaman & Yesilyurt, 2021) did not provide BSFC data for n-Pentanol, so comparisons were made with the other blends.

Two figures were constructed and analyzed in this study, emphasizing the comparison of BTE and BSFC values for different blends.

BTE line graphs (see Figure 1) are segmented into three experimental setups, showcasing net maximum power and CR. Other modifications are excluded for clarity. At a 40% engine load, there's a notable BTE reduction in each test. As engine load increases, most blends' BTE aligns with the 20% load, except for n-Pentanol blends which exhibit a moderate decline.

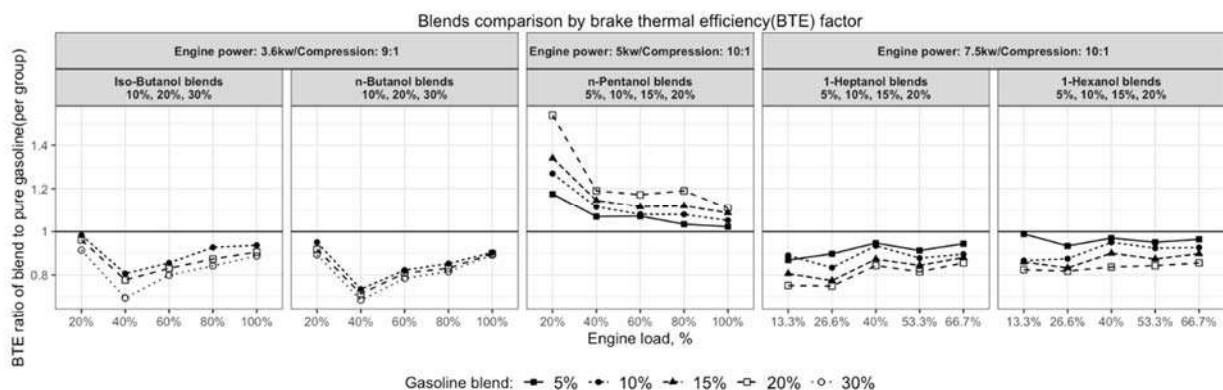


Figure 1. Brake thermal efficiency of alcohol blends under varying engine loads
(This work).

Surprisingly, n-Pentanol consistently outperformed pure gasoline in BTE throughout the tests. As for the influence of alcohol content, a rise in content generally led to a BTE drop, most pronounced with 1-Heptanol and 1-Hexanol blends. Contrarily, n-Pentanol demonstrated the highest BTE with a 20% n-Pentanol and 80% gasoline blend.

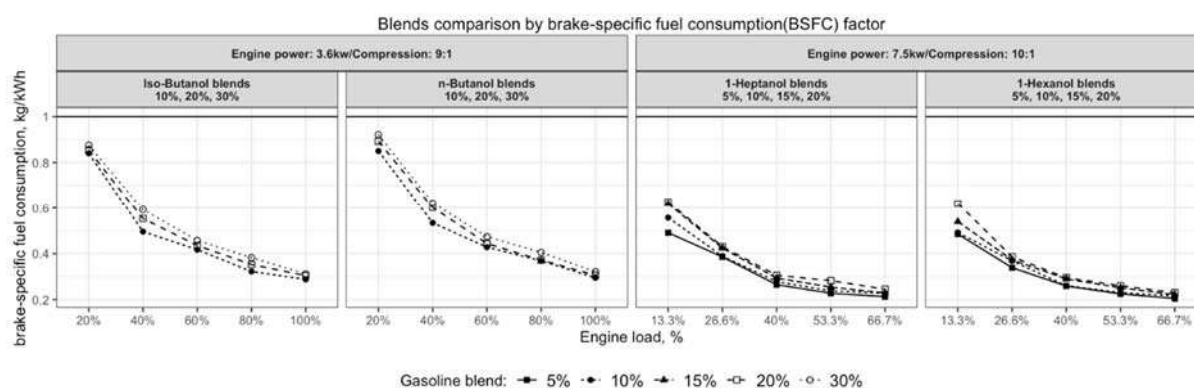


Figure 2. Brake-specific fuel consumption of alcohol blends under varying engine loads (This work).

Subsequent graphs (see Figure 2) present BSFC data for blends, excluding n-Pentanol. A trend can be seen: as engine load increases, BSFC decreases, indicating potential fuel savings under high engine loads. While different alcohol contents had a minimal impact, higher alcohol content generally resulted in increased BSFC.

Comparing BTE and BSFC data, 1-Hexanol and 1-Heptanol blends exhibited superior performance over Iso-Butanol and n-Butanol blends. Only n-Pentanol blends surpassed pure gasoline in BTE, underscoring its potential as an efficient gasoline substitute. However, the lack of BSFC data requires further exploration to fully understand n-Pentanol's capabilities.

This research introduced a comparative algorithm for analyzing blends across different experimental setups, streamlining blend evaluations. The C4-C7 alcohol blends were thoroughly assessed. Notably, n-Pentanol showcased superior Brake Thermal Efficiency, surpassing the benchmark fuel. While C6-C7 blends demonstrated moderate BTE and reduced fuel consumption, C4 blends lagged in performance. Given these findings, n-Pentanol emerges as a promising gasoline alternative, warranting further investigation.

References:

1. Ashok, B., Saravanan, B., Nanthagopal, K., & Azad, A. K. (2019). Investigation on the Effect of Butanol Isomers with Gasoline on Spark Ignition Engine Characteristics. Woodhead Publishing.
2. Yaman, H., Doğan, B., Yeşilyurt, M. K., & Erol, D. (2021). Application of Higher-Order Alcohols (1-Hexanol-C6 and 1-Heptanol-C7) in a Spark-Ignition

Engine: Analysis and Assessment. Arabian Journal for Science and Engineering.

3. Yaman, H., & Yesilyurt, M. K. (2021). The influence of n-pentanol blending with gasoline on performance, combustion, and emission behaviors of an SI engine. Engineering Science and Technology, an International Journal.
4. Yunus, I. S., & Jones, P. R. (2018). Photosynthesis-dependent biosynthesis of medium chain-length fatty acids and alcohols. Metabolic Engineering, (49), 59–68.

GLOBAL WARMING

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In 2022, greenhouse gas emissions in the European Union's economy amounted to 1.029 billion tonnes of CO₂-equivalent (CO₂-eq), which is 7% and 6% higher compared to 2020 and 2021, respectively, while the EU's economy emitted 1.035 billion tonnes of CO₂, still below the levels recorded before COVID-19 in 2019," he said.

Meanwhile, in terms of CO₂ emissions, Ukraine ranks 35th among countries worldwide, with 189.3 million tonnes per capita in our country, according to the World Population Review. Ukraine is not a leader in terms of greenhouse gas emissions, but it is actively approaching the top 50 countries with the most polluted air.

According to Our World in Data, the construction sector is one of the sectors with the highest CO₂ emissions.

Now, let's remember that CO₂ is the main sponsor of a massive global problem for our planet and humanity - global warming. Such damage to nature will not go unnoticed, as excess CO₂ in the atmosphere leads to a rise in temperature, accelerating global warming. This creates what is known as the "greenhouse effect"

and disrupts the global carbon cycle, absorbing excess heat. In addition, excessive greenhouse gas emissions contribute to the acidification of water bodies, lowering the pH level.

The international community is taking a global approach to addressing environmental issues. Innovative solutions to the problem of excessive CO₂ emissions were presented at the World Changing Ideas Awards ceremony, one of the main annual programs of Fast Company focused on societal well-being and aimed at improving the quality of finalized products and daring ideas that make the world a better place.

One of the global leaders in digital transformation in energy management and automation, the German company Schneider Electric, was recognized in the "Construction" category of the prestigious Fast Company World Changing Ideas Awards 2022. The reward was given for IntenCity, a new zero-carbon unique building of the future located in Grenoble, France. Since buildings account for about 40% of global CO₂ emissions and over 30% of energy consumption, the industry must massively adopt digital technologies to achieve better and more efficient results by forecasting and minimizing waste. Energy consumption in IntenCity is 10 times lower than that of an average European building. The building does not burn anything, and all energy comes from renewable sources.

The ultimate goal is to combine progress and sustainable development so that everyone can use energy and resources as efficiently as possible. This concept is called "Life Is On."

In this way digital partners for sustainability and efficiency support technical transformation by integrating the best processes and technologies into energy management, product connectivity, cloud solutions, management tools, software, and services throughout the equipment's entire life cycle.

So, comprehensive management for buildings, structures, data centers, infrastructure, and industrial facilities is provided on the bases of open standards and partnerships with everyone who shares desire to improve the quality of life and values diversity, equal opportunities, and self-realization.

Reference:

Schneider Electric <https://www.se.com/ww/en/>

AUTONOMOUS VEHICLES AND ARTIFICIAL INTELLIGENCE: PERSPECTIVES ON SAFETY AND EFFICIENCY IN FUTURE TRANSPORT

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Nowadays, when technology has become almost the pinnacle of human development, it is very difficult to invent and develop something completely new. New inventions are mostly derivatives or improved versions of what was already invented several decades ago. For example, today's artificial intelligence is an impressive example of today's technology, although the very first ideas and prototypes, as well as the very prerequisites for the emergence of this phenomenon, were in the second half of the twentieth century. It was a set of algorithms that allowed analysing and developing appropriate tactics depending on the situation in a chess game (Podgayetsky, 2012).

It was artificial intelligence that began to be used to improve vehicle safety and autonomy. AI helps prevent human error. From the very beginning, systems with data pre-processing were used to facilitate the driver's work in many aspects, such as error detection, mapping and location, and prediction of the movement of objects on the road. A large number of sensors operate in real time and provide autonomous decision-making, which greatly reduces the risk of accidents due to human error (Abbasi, 2023).

Due to the fact that the driver's life is at stake when driving an autonomous system, safety and reliability depends on the speed of the entire architecture, which includes the sensors, the system that will interpret the data received from the sensors, and the execution of actions based on the results. All of these stages equally affect the speed of decision-making and must work in a split second, which is what matters

most - road safety. Sensors should work even in bad weather conditions and the integrated system should respond to any emergency as quickly as possible (Abbasi, 2023).

It is Artificial Intelligence and Advanced Driver Assistance Systems (ADAS) that warn us in real time that there is an obstacle in front of the vehicle, or control adaptive cruise control, or the movement of the entire vehicle. All these systems use cameras and other sensors and machine learning algorithms to make decisions. Machine learning algorithms are trained on the basis of a large amount of data, created artificial scenarios of various situations and options for their solution. In addition, AI can warn of technical malfunctions and the need for repair (Karunamurthy, 2023).

Given the fact that an autonomous vehicle has advantages that ease human dependence on a vehicle, some European countries, including Germany and the ZF inland transport system, plan to make some public transport based on unmanned shuttles for greater comfort in European cities over the next five years. This will reduce traffic in cities that depend on nearby roads and airports (BBC, 2021).

In conclusion, we would like to add that the field of artificial intelligence is one of the most important and complex inventions from an engineering point of view, which can take place in many areas of life. As an example of the creation of autonomous transport systems, we are already seeing unmanned taxis and even the delivery of goods by unmanned trucks. So far, these technologies are quite expensive, and therefore it can be argued that this phenomenon will not be as widespread for several years, but when the technologies become cheaper, we will be able to use them every day.

References:

1. Podgayatsky, O. (2012). Evolution of developments in the field of artificial intelligence in Ukraine and the world. Studies in the history of technology. *[From Ukr.: Evolyutsiya rozrobok u sferi shtuchnoho intelektu v Ukrayini ta sviti. Doslidzhennya z istoriyi tekhniky]* (issue 16), 48-49. October 11, 2023. <https://ela.kpi.ua/bitstream/123456789/7703/1/RHT-issue-16-title-05-Podgayetsky.pdf>

2. Abbasi, S. (2023, 11 October). Artificial intelligence and software modeling approaches in autonomous vehicles for safety management: A systematic review. MDPI. <https://www.mdpi.com/2078-2489/14/10/555>. October 12, 2023.
3. Karunamurthy, S. (2023, June). AI-based Self-Driving Car. ReserchGate. https://www.researchgate.net/publication/372960513_AI-based_Self-Driving_Car. October 14, 2023.
4. Cusack, J. (2021, 30 November). How driverless cars will change our world. BBC. <https://www.bbc.com/future/article/20211126-how-driverless-cars-will-change-our-world>. October 18, 2023.

TECHNOLOGICAL BREAKTHROUGHS IN PAST, PRESENT AND FUTURE

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Technological breakthroughs are moments of significant development or achievement that can revolutionize industry, society, the market, and others. Which leads to the creation of new products, analyses, and services for humanity. Technological breakthroughs have occurred throughout humanity’s history; one breakthrough in the past leads to more discoveries in the future. For example, the sphere of nuclear energy started great development in the early past; in the 20th century, up to this day, this sphere has developed and has great potential in the future.

One example of a technological breakthrough in nuclear energy in the past is the first controlled nuclear fission, which occurred on December 2, 1942, at the University of Chicago. Enrico Fermi and his team of physicists have built the World’s first nuclear reactor, called “Chicago Pile-1 (CP-1)” It used ultra-pure graphite and uranium, which created a self-sustained chain reaction of nuclear fission. The discovery of the ability to control nuclear fission has given humanity a new source of energy that we now use to provide a great amount of it for civilian use.

However, nuclear fission has downsides such as high production of radioactive waste, the chance of catastrophe, and less production of energy than nuclear fusion. Because of these circumstances, this led to research into potential nuclear fusion.

On December 13, 2022, a technological breakthrough in net energy gain from nuclear fusion was discovered. Scientists from the US announced that they were able to gain more energy from fusion reactions, then waste energy on rising temperatures for the fusion to start. However, nuclear fusion still has some challenges that have to be overcome before using it, one of which is the ability to sustain the nuclear reaction for a longer time.

But this gives humanity huge potential to use nuclear fusion in the future, considering that if other challenges are surpassed, this will lead to a great technological breakthrough. Nuclear fusion is considered to be “clean” compared to nuclear fission. Fusion doesn’t produce greenhouse gases, produces less radioactive waste, uses abundant and cheap fuel sources for producing energy, and also has less risk of accidents and catastrophes. From an energetic point of view, nuclear fusion also produces more energy than nuclear fission, which, as a result, means that nuclear fusion surpasses fission drastically.

Analyzing the information, we can say that technological breakthroughs give more space and ways for research and discovery now, which humanity uses for future benefits and gains.

References:

1. By Tom Siegfried (November 29, 2017). First controlled nuclear chain reaction achieved 75 years ago. Retrieved from <https://www.sciencenews.org/blog/context/anniversary-first-controlled-nuclear-chain-reaction?ssp=1&darkschemeovr=1&setlang=uk-UA&safesearch=moderate>
2. By Artemis Spyrou, Wolfgang Mittig, (December 3, 2017) Atomic Age Began 75 Years Ago with the First Controlled Nuclear Chain Reaction. Retrieved from <https://www.scientificamerican.com/article/atomic-age-began-75-years-ago-with-the-first-controlled-nuclear-chain-reaction/>

3. By Adrienne Vogt, Mike Hayes, Ella Nilsen and Elise Hammond (December 14 2022) US officials announce nuclear fusion breakthrough. Retrieved from <https://edition.cnn.com/us/live-news/nuclear-fusion-reaction-us-announcement-12-13-22/index.html>

4. Fission vs Fusion. (2013, 6 December). Retrived from <https://research.binus.ac.id/rigpcs/2013/12/06/fission-vs-fusion/>

INNOVATIVE ORGANIC NANOZYMES: A GAME-CHANGER FOR SUSTAINABLE FARMING AND SOIL HEALTH

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In the conditions of a growing population, a drastic increase in consumerism and the negative effects of climate change, the concept of sustainable agriculture is becoming particularly critical.

To solve the problem of soil degradation, it can be extremely important to use nanozymes, which are nanomaterials with enzymatic activity, but with greater strength and stability, compared to natural enzymes.

«...nanozyme is derived from nanomaterial and enzyme. Nanozymes were first developed about 15 years ago, when researchers found that iron oxide nanoparticles may perform catalytic activity similar to natural enzymes (peroxidase)» (Lee & Kamruzzaman, 2023, p. 12).

Nanozymes can completely replace peroxidase, a highly effective catalyst in the digestion processes of biologically active substances by plants, although it has many disadvantages, including excessively high cost, limited stability, and temperature and pH dependence.

Dong Hoon Lee mentions: the nanozymes that have been synthesized until now are created from inorganic metal materials (For example, Fe-based single-atom NZs), and therefore were not suitable for agricultural or food industry use, due to their high

toxicity and excessive production costs.

It is claimed that nanozymes synthesized on the basis of organic compounds, unlike traditional enzymes are easier and cheaper to produce, non-toxic and don't inflict any damage on the environment. Nanozymes can be created via a self-assembling one-pot particle synthesis procedure, showing good kinetic properties and pH stability.

It is promising to use them as an alternative to nitrate fertilizers, due to their significant positive effect on the growth of crops, a reduced rate of soil depletion, and low toxicity for humans.

Also, an attractive field for research is the development of a portable and applicable test kit for farmers and consumers, relying on a colorimetric sensor system: In order to identify specific molecules of interest, the scientists integrated an optical sensing method with the OC nanozyme, resulting in a colorimetric sensing device. This device uses variations in color intensity, with darker colors indicating lower concentrations of the target molecules. Colorimetric assays utilize this optical method to determine the presence and concentration of specific molecules in a given sample.

References:

Baily, S. (2023, October 17). Organic compound-based nanozymes for detecting agricultural herbicide. *AZONANO*. Retrieved October 31, 2023, from <https://www.azonano.com/news.aspx?newsID=40461>.

Cui, Z., Li, Y., Zhang, H., Qin, P., Hu, X., Wang, J., Wei, G., & Chen, C. (2022). Lighting up agricultural sustainability in the new era through Nanozymology: An overview of classifications and their agricultural applications. *Journal of Agricultural and Food Chemistry*, 70(42), 13445–13463. <https://doi.org/10.1021/acs.jafc.2c04882>

Lee, D.H., & Kamruzzaman, M. (2023). Organic compound-based nanozymes for agricultural herbicide detection. *Nanoscale*, 15(31), 12954–12960. <https://doi.org/10.1039/d3nr02025h>

Waris, Hasnat, A., Hasan, S., Bano, S., Sultana, S., Ibhaddon, A.O., & Khan,

M.Z. (2023). Development of nanozyme based sensors as diagnostic tools in Clinic Applications: A Review. *Journal of Materials Chemistry B*, 11(29), 6762–6781. <https://doi.org/10.1039/d3tb00451a>

INNOVATIVE APPROACHES TO SOLVING THE PROBLEM OF GLOBAL WARMING

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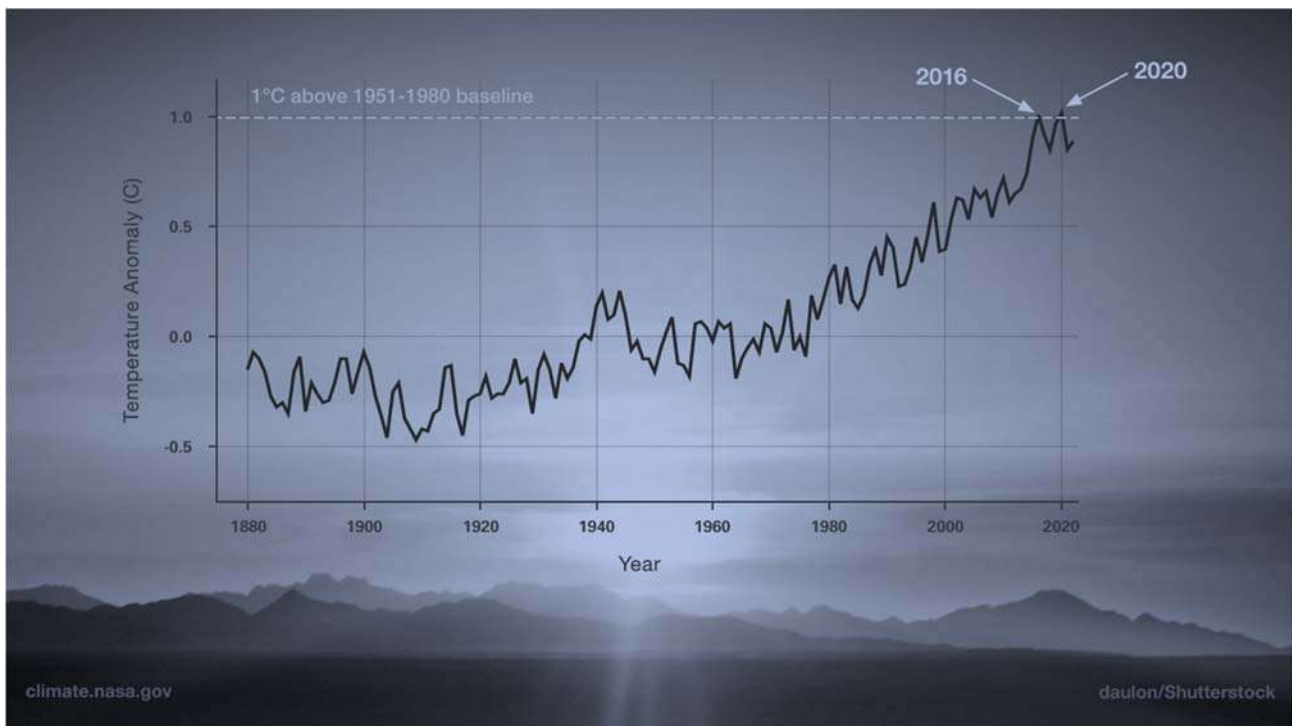
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Global warming is known to be the increase in the Earth's surface temperature over an extended period, leading to significant alterations in the planet's climate, which causes global climate change. At the moment, this is one of the biggest environmental issues that humanity has faced.

According to information on NASA's official website, this phenomenon has been evident since the pre-industrial era (between 1850 and 1900) and is primarily attributed to human actions, particularly the combustion of fossil fuels, which results in higher levels of heat-trapping greenhouse gases in the Earth's atmosphere.

Over the period since the pre-industrial era, it is estimated that human activities have raised the Earth's global average temperature by approximately 1 degree Celsius (1.8 degrees Fahrenheit). This temperature increase is currently accelerating at a rate exceeding 0.2 degrees Celsius (0.36 degrees Fahrenheit) per decade. The present warming trend is unequivocally linked to human activity since the 1950s and is occurring at an unparalleled pace in comparison to historical patterns.



The accompanying graph illustrates the shift in global surface temperatures relative to the average temperatures during the period 1951-1980. Notably, the Earth's global average surface temperature in 2020 was statistically on par with 2016 as the hottest year on record, highlighting the persistent long-term warming pattern attributed to human activities.

The rise in the Earth's average air temperature, commonly referred to as global warming, is one of the most important problems of our age. This phenomenon has a serious impact on our climate, natural resources, and the lives of humans and other living organisms. Thanks to scientific research and the development of technology, we finally have breakthroughs in the fight against this phenomenon.

The greatest achievements in solving this problem are Climate informatics and modeling that play an important role in understanding and combating global warming. The development of modern technologies allows us to better understand and predict changes in the climate. Supercomputers and specialized programs make it possible to conduct more accurate climate models and analyze huge amounts of data to make science-based decisions in the fight against global warming.

Climate models enable scientists to forecast future climate alterations under varying scenarios of greenhouse gas emissions and other variables. This capability equips society to get ready for anticipated changes and formulate adaptation

strategies.

Analysis of climate models creates optimal measures and tactics for mitigating greenhouse gas emissions and addressing other contributors to global warming.

Climate informatics provides scientific data and analysis that inform policy decisions about greenhouse gas emissions regulation, renewable energy development, and other mitigation strategies. It is ready to collect and analyze data on climate change, including air temperature, sea level and other indicators, allowing scientists to monitor the progress of reducing global warming.

Also, climate informatics and modeling create an opportunity for global cooperation and exchange of data and knowledge among countries, which is fundamental to solving global climate change problems.

In general, these technologies are tools for understanding, analyzing, and responding to global warming, and they play they have a significant role in the formulation of strategies to mitigate and adapt to climate change. Although climate informatics and modeling do not eliminate the danger of global warming, they play a key role in understanding, monitoring and solving this problem, providing a scientific basis and helping to make informed decisions.

References:

1. Anya Biferno, Holly Shaftel, Susan Callery, Randal Jackson, Daniel Bailey, Susan Callery. What Is Climate Change? [Climate Change: Vital Signs of the Planet]. Retrieved from <https://climate.nasa.gov/what-is-climate-change/> [in English]. (2023, October, 27).
2. Anya Biferno, Holly Shaftel, Susan Callery, Randal Jackson, Daniel Bailey, Susan Callery. Global Surface Temperature | NASA Global Climate Change [Climate Change: Vital Signs of the Planet]. Retrieved from <https://climate.nasa.gov/vital-signs/global-temperature/> [in English]. (2023, October, 27).

3. Максименко Н. В. Фрактальний підхід до моделювання природних систем/ Н. В. Максименко //Географія в інформаційному суспільстві. Зб. наук. праць. У 4-х томах. – К.: ВГЛ Обрії, 2008.

ROBOTIC INTEGRATION IN OUR LIVES

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The integration of robots into our lives has become so intense that we sometimes do not notice it. But the fact that we do not notice it does not mean that it does not significantly affect our everyday life.

The influence of automated machines is probably most noticeable in the field of production. Any factory cannot exist without equipment that would help in the production of goods. Also, many companies are already on the way to adding artificial intelligence to production. According to Zipdo’s “Essential Factory Automation Industry Statistics in 2023”, over the next five years, 85% of manufacturing managers believe that artificial intelligence and automation will play a very important role in the operation of their factories (Essential factory automation industry statistics, 2023).

It is also impossible not to mention the impact of robotic machines on medicine. Modern technology improves the efficiency, availability, and quality of medical care, which in turn helps both healthcare providers and patients. Referring to “Essential Automation in Healthcare Statistics in 2023”: machine learning and predictive analysis can lower patient readmissions more than 20% and automation of the medical paperwork of a medical worker will help to increase the time that can be devoted to the patient by 33% (Essential automation in healthcare statistics, 2023).

A very convenient automation and more visible to the common man is the automation of banking and finance. Each of us cannot imagine life without bank accounts and cards. Automated financial systems help in managing finances, trading,

and banking operations. In obedience to “Essential Automation in Financial Services Statistics in 2023”, by 2022, banks will be able to almost completely serve customers and process data using automated processes, and more than 70% of banks are interested in investing money in automation and robotization (Essential automation in financial services statistics, 2023).

Of course, these are not all areas affected by automation and robotics, but they are some of the most common. In general, the transition to the use of machines in many processes that were previously performed by people is a great saving and optimization. However, there are significant disadvantages to this phenomenon. Many people lose their jobs. There have been many examples in history of how many people were left unemployed during the Industrial Revolution. This can happen in our time as well. A couple of years ago, various AI services began to appear, which could partially replace the services of such people as designers, programmers, marketers, and many others. But there is a way not to lose your job, in my opinion, it is not to ignore AI and be against it, but on the contrary to use it to make it easier and more efficient for your workers to perform their tasks.

After all, AI and other technologies are not created to make our lives harder, but conversely to make them easier.

References:

1. Essential factory automation industry statistics in 2023. (2023, August 8). Retrieved from <https://zipdo.co/statistics/factory-automation-industry/>
2. Essential automation in healthcare statistics in 2023. (2023, August 6). Retrieved from <https://zipdo.co/statistics/automation-in-healthcare/>
3. Essential automation in financial services statistics in 2023. (2023, July 25). Retrieved from <https://zipdo.co/statistics/automation-in-financial-services/>
4. A short history of jobs and automation. (2020, September 3). Retrieved from <https://www.weforum.org/agenda/2020/09/short-history-jobs-automation/>

ECOLOGICAL PROBLEMS OF WATER RESOURCES IN UKRAINE

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Actually, there are many problems with water resources in the world. Unfortunately, Ukraine is not an exception in this regard. At this poor rate, by 2025, two-thirds of the world will experience a shortage of drinking water. Therefore, many scientists devote their activities to solving this problem.

Regrettably, Ukraine is one of the countries in Europe that is least supplied with water. The ecological condition of river basins and territorial waters of the Azov and Black Seas is deteriorating due to toxic and biogenic pollution. Saturated use of groundwater in our country leads to significant depletion of groundwater horizons. In many regions, groundwater quality does not meet official requirements.

Due to the peculiarities of geographical conditions, the distribution of water and the chemical composition of the underground hydrosphere on the territory of Ukraine are uneven. The largest water resources are located in the northern and northwestern regions of Ukraine. In return, the southern regions of the country are not rich in water resources. The ecological situation in these regions does not allow normal consumption and use of these waters.

The main consumers of water are industry - 36%, agriculture - 41%, communal economy - 23%. (Safranov T., Berlinskyi N., & Volkov A., 2016, p. 124) Industry includes electric power, chemical industry and metallurgy. Water is an important resource for agriculture, without which it would not exist.

The primary polluters of Ukraine's water resources are the coal industry, metallurgical, energy, chemical and municipal enterprises. The municipal economy accounts for half of the harmful emissions of substances into water. Owing of the powerful influx of pollutants into groundwater, their pollution has increased more than 4 times in the last 20 years alone.

High temperature in summer also affects water quality, which causes the

mass “blooming” of water and reduces the level of dissolved oxygen. Regrettably, little attention is paid to this problem, so the vegetation in the water simply rots, due to which the quality of the water deteriorates significantly.

According to modern tests, deviations from the norm in organoleptic indicators (up to 72%), overnormal mineralization up to 28%, and an excess of chemical substances up to 16% are found in drinking water samples.

Urgant measures regarding economical and rational use of water resources:

- development of reasonable irrigation standards
- replacement of water units with air cooling units
- application of reverse water supply systems
- implementation of waterless water uses systems (full cycle of sewage pipe cleaning)
- decrease in the percentage of water-intensive industries in Ukraine
- protection of underground and surface waters from pollution
- preserving the quality of natural and drinking waters

The most innovative sustainable methods of water purification should be paid special attention:

- Reverse osmosis. Reverse osmosis filters are one of the newest filters that provide, perhaps, the most advanced water purification today. With their help, water is purified from almost all substances dissolved in it, organic impurities, inorganic chemical compounds, salts of heavy metals, viruses, bacteria and microbes.
- Nanofiltration. One of the most progressive technologies, noted for its versatility. Deprives water of color characteristics, halogen-containing organic impurities, without requiring addition of reagents. It involves both filtration and coagulation, sometimes it may require preliminary ultrafiltration or reverse osmosis.
- Photocatalysis. Another innovative technology, the essence of which is that suspended and dissolved organic impurities are removed from surface water sources without preliminary cleaning and chemical treatment. It envisages the

involvement of a capillary membrane (one or several).

Conclusion:

At the moment, the water infrastructure of Ukraine needs changes and reconstruction. The first task is to improve water quality and preserve the quantity of drinking water. It is of vital importance to fight these environmental problems, because it affects all citizens of the country and it directly concerns the preservation of nature for future generations.

References:

1. Dorohuntsov S. I., Kotsenko K. F., Khvesyk M. A. ta in. Ekolohiia: pidruchnyk. K.: KNEU, 2005. 371 s.
2. Safranov T., Berlinskyi N., & Volkov A., (2016, April 22). Water resources of Ukraine: usage, qualitative and quantitative assesment (with detaile description of odessa region).

PROSPECTS OF ARTIFICIAL INTELLIGENCE

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Artificial intelligence is getting a lot of attention these days. People are more interested in it because it is making a big impact on many areas of our lives. Businesses, researchers, and others are investing in AI technology, leading to new and exciting developments. This growing interest shows how AI is becoming a significant part of our modern world.

It is likely that future healthcare professionals won't be humans. Artificial intelligence has already begun to make its way into doctors' practices, so experts are certain that it's just a matter of time before it becomes commonplace. “From advanced diagnostic algorithms to precisely calibrated surgical robots, this technology is becoming more prevalent across all medical disciplines.” The report also stated that artificial intelligence has proven its capability to assess the risk of

age-related illnesses like cancer and heart disease (Pogorelenko, 2019).

Certainly, the integration of AI-powered educational technologies is revolutionizing the learning landscape. By offering tailored learning experiences, adaptive assessments, and interactive content, these advancements are not only improving education accessibility and quality but also fundamentally changing how students engage with information and acquire knowledge.

Individuals will soon have personal assistant robots at their disposal. Major companies like Google, Amazon, and Microsoft are already providing home assistants that can execute various household tasks. Through voice commands, these assistants can control lighting, ventilation, music, manage schedules, provide traffic updates, deliver global news, and even suggest nearby restaurants tailored to your preferences (Fernandes, 2023).

Artificial intelligence now stands as the cornerstone of cybersecurity defenses, acting as a vigilant protector amidst the continuously changing realm of cyber threats. Through detailed analysis of network traffic patterns, AI algorithms can rapidly pinpoint deviations or irregularities that could signify possible security breaches. These advanced systems excel at early threat detection, being capable of identifying established attack patterns as well as new, previously undiscovered threats (Sharma, 2023).

In the coming years, homes and cities are set to embrace the concept of becoming “smart”. The internet’s extensive connectivity now spans a multitude of devices, extending well beyond traditional computers and smartphones to include a diverse range of gadgets. This phenomenon, known as the “Internet of Things”, is increasingly gaining momentum. Currently, numerous thermostats available empower users to control their home’s temperature remotely using a smartphone, even when they are far away (Ravar, 2023).

Artificial intelligence has advanced to the point where it can create custom music and write books designed specifically for individual preferences. Recently, it demonstrated its capabilities by producing a calming lullaby, a creation validated by the overseeing medical experts for its therapeutic effects. As AI continues to evolve,

it holds the potential to revolutionize the entertainment and literary industries, offering tailored experiences to audiences worldwide.

AI-enabled predictive maintenance is revolutionizing industries by leveraging advanced algorithms and data analytics to foresee potential issues in machinery and infrastructure before they lead to costly breakdowns. This approach offers several significant advantages beyond reducing downtime, improving safety, and prolonging equipment lifespan (Finogeev, 2019).

In conclusion, the prospects of artificial intelligence are awe-inspiring and transformative. As this technology continues to evolve, it promises a future where automation and innovation work hand in hand, enhancing various aspects of our lives and reshaping industries. From revolutionizing healthcare with personalized treatments to creating smart cities that optimize resources, AI stands as a beacon of progress.

References:

Fernandes, C. (2023, June 26). *The Era of AI Personal Assistants: A Glimpse into Our Future Lifestyle*. Retrieved from <https://www.linkedin.com/pulse/era-ai-personal-assistants-glimpse-our-future-claudio-fernandes>

Finogeev, A. (2019, September 15). *Intelligent monitoring system for smart road environment*. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S2452414X18300542>

Pogorelenko, A.K. (2019, 31 May). *Artificial intelligence: essence, application analysis, development prospects*. Retrieved from <https://ej.journal.kspu.edu/index.php/ej/article/view/405/401>

Ravar, A. (2023, July 21). *How will AI impact the smart home industry?* Retrieved from <https://www.linkedin.com/pulse/how-ai-impact-smart-home-industry-amit-ravat>

Sharma, H. (2023, October 19). *Innovation on the Horizons: Upcoming Tech-Breakthroughs and Next Generation AI*. Retrieved from <https://www.techaheadcorp.com/blog/next-generation-ai/>

SMART TECHNOLOGIES IN SCIENCE AND ART

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Over time, humanity reaches new heights and one of the key paths on this journey is through innovations in the fields of art and science. Have opened up new horizons for creativity and exploration, modern technologies carry the potential that recently seemed unattainable. In this article we will explore how these technologies have a significant impact on the cultural and intellectual aspects of human life. We will begin with a description of the history of technologies in art and science and then move on to contemporary achievements and the prospects that lie ahead.

The History of Technologies in Art and Science. The history of humanity has always been intertwined with art and science, and over time, both of these domains continue to evolve through the development of new technologies. Let's take, for example, the art of painting. In ancient times artists used primitive tools like stones and pigments to create their works on cave walls and rocks. As civilizations advanced, artists began to employ feathers, brushes, and oils to craft more intricate and expressive paintings.

With the progress of science and technology in the Middle Ages, artists started incorporating perspective and chiaroscuro to create realistic works. The need for new materials and tools arose, enabling artists to better manifest their ideas. The emergence of photography in the 19th century also left an imprint on art by providing a new way to capture and depict moments.

With the advent of computers and digital technologies in the 20th century, artists gained a powerful tool for creating art. Graphic software and digital drawing tablets extended the artist's palette. Artists could experiment, crafting works free from the constraints of traditional materials.

Research in the realm of science and technology also experienced significant growth. Microscopes, satellites, and supercomputers aided in deepening our understanding of the world and led to the development of new research methods.

Neural networks and machine learning have become instrumental for data processing and scientific investigations.

Modern Innovations and Achievements. In our modern era, advanced technologies are causing a revolutionary impact on both art and science. In the realm of art, digital technologies have emerged, facilitating the creation of music, images, and literary works with minimal human involvement. One of the key achievements lies in the application of neural networks and artificial intelligence, which have become capable of generating works of art based on human input. Artificial intelligence has not only increased productivity but has also opened new creative horizons, providing artists and musicians with powerful tools to bring their ideas to life.

In the field of science, modern technologies are reshaping traditional research approaches. The development of artificial intelligence, including neural networks and deep learning, allows for the analysis of vast datasets and the extraction of valuable scientific insights. For example, neural networks are successfully applied in medicine for the analysis of medical images and disease diagnostics. These technologies significantly expedite research processes and enhance their precision.

Prospects of Future Technological Innovations. In the future, innovations in both art and science promise to be even more astonishing. Progress in the field of neural networks and artificial intelligence continues to grow, and we can expect technologies to become even more accessible and powerful. In the realm of art, this could lead to the emergence of new art forms created in collaboration with artificial intelligence. It may also change the way we perceive art, as works will be generated based on individual requests and preferences.

The development of neural networks holds the promise of opening new frontiers in the creation of virtual worlds where science and art will merge into a single entity. These powerful tools will enable the creation of environments in which researchers and artists can materialize their boldest ideas, transcending the limitations of the physical world and immersing themselves in a realm of new possibilities.

In the field of science, neural networks and artificial intelligence can enhance

and expedite research across various disciplines, including biology, physics, and computer science. We can anticipate more precise and faster methods for analyzing and comprehending complex processes in nature and society.

References:

1. Simon, H. (1995), Artificial Intelligence: Empirical Science, 96-101
2. Helman, D. (2013), Similar Reasoning: Perspectives on Artificial Intelligence, Cognitive Science, and Philosophy, 103 – 142.
3. Brooks, R. (1991) Intelligence without representation Artif. Intel., 139-159.
4. Abrantes P. (1999) Analogous reasoning and modeling in the sciences. - Fundamentals of Science 4 (3): 237-270.

ECOLOGICAL PROBLEMS WITH WATER RESOURCES IN UKRAINE

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Nowadays, humanity suffers from lots of ecological problems. People face the air, water, soil pollution, animal extinction, climate change and deforestation. The technical progress brought not only advantages, but also it caused rising of numerous ecological problems, which influence people's lives. Due to them, population in the different parts of the Earth has a lot of diseases, lack of food, water and clean air.

Of course, Ukraine is not an exception. There is a quite big number of plants and factories which cause the ecological problems and influence the environment. And, of course, the war, which is continuing, influences the ecology greatly.

One of the biggest problems in Ukraine, like throughout the world, is with water resources. They belong to national treasures of every country, and help it in developing. Throughout history, our water resources, which include rivers, lakes, reservoirs, ponds, and canals, have provided people with water for different activities. The biggest Ukrainian river, the Dnipro, which is “the father” of the nation, now is polluted greatly. The water reserves, which are situated on it, cause the water bloom

and fish plague every summer. It happens because of chemicals from plants and farming that go into the river. This pollution not only influences the plants, fish and animals of the river, but it is also a reason of many health problems, because this water is used for drinking and irrigating.

Other big rivers, such as the Desna, the Bug, the Donets are also suffering from the industrial and agricultural pollution.

Moreover, the ongoing war in Ukraine has the great impact on ecology. Russian troops have destroyed one of the artificial reservoirs on the Dnieper River and the southern part of Ukraine, which had problems with water supply earlier, are now suffering from a lack of water. Of course, the conducting military activities impact the using of water for industry and agriculture. But people still have a great need of clean drinkable water.

Furthermore, different ecological groups, activists and volunteers should pay great attention to this problem. Different educational programs and ecological campaigns should be conducted to promote responsible water usage. The government should use all its power to save Ukrainian water resources.

In conclusion, ecological problems with water resources in Ukraine are a great issue. And they have to be solved as fast as it is possible. Because water is a vital and essential resource and such problems cannot be ignored.

Reference:

International Science Group. (2020). Prospects for the development of modern science and practice. Retrieved from: <https://isg-konf.com/wp-content/uploads/2020/05/XVI-Conference-11-12-Graz-Austria.pdf>

CONSEQUENCES OF GLOBAL WARMING

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World Climate Day is celebrated annually on December 8, initiated by several

environmental associations in France and Belgium. These events in the first days of December have a traditional annual character and are aimed at raising awareness of climate problems caused by global warming.

People often compare climate with weather, but in reality, there are significant differences between these concepts. The weather changes every day: sometimes it rains, sometimes it's sunny, sometimes it is snowing. Climate is the pattern of weather conditions over a large area or continent over a long period of time. Today, we are convinced that during the history of the Earth's existence, the climate has changed many times. Scientists know for sure that there were about seven ice ages, which were replaced by global warming, which left its mark on life of our planet. Currently, even in Ukraine, archaeologists are finding mammoth and dinosaur bones. Millions of years have passed since the first climate change, and now, thanks to the latest technologies, not only climate change, but also climate crises are occurring more and more often.

There is no doubt that human activity is exacerbating climate change, causing increasingly serious consequences that are felt by people everywhere. Scientists are also finding more evidence of a link between human activities and the extreme weather events they cause. These are frequent and intense heat waves, hurricanes, typhoons, melting of glaciers, rising water levels, warming and acidification of the World Ocean. As global temperatures rise, natural disasters are becoming more common, and some countries are damaged more and more. According to the World Meteorological Organization, the number of disasters has increased five-fold over the past 50 years due to climate change. This causes a daily loss of \$202 million.

Every year, more countries become aware of their vulnerability to climate change and the difficulty of recovering various sectors of the economy after emergencies. In 2013, “the Warsaw International Mechanism” emerged, which stated that losses and damages related to the negative effects of climate change include those that can be reduced through adaptation. However, the Warsaw Mechanism does not provide for liability or compensation for losses and damages.

The Paris Agreement, signed in 2015, also includes provisions on the coverage

of damages. Among other things, the signatories recognize the importance of preventing or minimizing losses caused by climate change phenomena. It is one of the cornerstones of the climate talks, as developed countries are reluctant to provide funding and are concerned that it could lead to legal liability for the effects of climate change. Fragile countries have highlighted their urgent need for disaster recovery funds. Seychelles, Marshall Islands, Canary Islands, Federated States of Micronesia, French Polynesia, Philippines, Tuvalu, Solomon Islands (have already lost 5 islands due to sea level rise).

Due to global warming, the world is experiencing major droughts and dust storms. A striking example is the fires in Australia in the winter of 2019-2020, during which more than 1 million animals were affected. Dry weather can trigger not only fires, but also sandstorms, when the wind blows dust into the air and carries it tens of kilometers. As a result, the fertility of the land decreases, desertification occurs.

Scientists believe that global warming is caused by rising levels of greenhouse gases, with levels of carbon dioxide in the air reaching their highest level in nearly 14 million years. Meanwhile, Earth's atmosphere transmits solar energy from space, but carbon dioxide and methane prevent the heat from returning. As a result, the Earth heats up like a greenhouse.

Another serious consequence of global warming is the melting of glaciers. Glacier loss has increased five-fold over the past decade. This directly affects the level of water in the world ocean, which is 2.5 times higher today than 10 years ago. As a result, by 2050, many settlements in the world will be washed away or completely flooded.

New pandemics are also a less obvious consequence of climate change. Global warming may "awaken" prehistoric viruses in glaciers, scientists say. The consequences of this can be a thousand times greater than the consequences of the Covid-19 pandemic.

But there is also an optimistic scenario: the Earth's temperature will rise to a critical 1.5 degrees, after which the Earth will begin to cool. However, to achieve this goal, people must stop burning fossil fuels and stop deforestation by 2030.

References:

1. Lidiia Kryshtop “Shcho my rozumiiemo pid zminoiu klimatu?” [Lidiia Kryshtop "What do we mean by climate change?"] Retrieved from <https://nbs.wwf.ua/shcho-my-rozumiiemo-pid-zminoiu-klimatu/>
2. Dmytro Raievskyi “OON vypustyla zvit pro klimat. Yakshcho korotko – bude duzhe spektakularno, voloho i tak po kolu. Os holovni tezy dokumenta i komentari yoho ukrainskykh rozrobnykiv [Dmytro Raievskyi "The UN released a report on the climate. In short, it will be very hot, humid and so on. Here are the main theses of the document and the comments of its Ukrainian developers"] (2021, August 20) Retrieved from <https://babel.ua/texts/68530-globalne-poteplinnia-ne-vigadka-tak-i-lyudina-yogo-priskoryuye-tak-i-dali-bude-tilki-girshe-mayzhe-napevno-golovni-tezi-zvitu-onn-pro-klimat-i-komentari-yogo-ukrajinskih-rozrobnykiv>
3. Hlobalne poteplinnia – problema, shcho ne maie kordoniv [Global warming is a problem that has no borders] (2019, August 9) Retrieved from <https://phc.org.ua/news/globalne-poteplinnia-problema-scho-ne-mae-kordoniv>
4. Vyrishalne desiatylittia. Osnovni tezy konferentsii OON z pytan zminy klimatu [The decisive decade. The main theses of the UN conference on climate change] (2021, November 1) Retrieved from <https://tyzhden.ua/vyrishalne-desiatylittia-osnovni-tezy-konferentsii-onn-z-pytan-zminy-klimatu/>

ROBOTIC INTEGRATION IN OUR LIVES

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Robots are machines created by people to make life easier. They are not alive. They have no soul, they are not able to feel, reproduce, and they do not need to eat, drink, or sleep. Their main task is the unquestioning execution of people's orders, with maximum speed and productivity.

Robots are economically beneficial. For example, an automated car wash, it is

completely autonomous, you don't have to pay them, it does not need rest, can work 24/7. Using the built-in program, you will not waste extra resources.

Robots are immortal. They cannot be killed, it is very difficult to destroy the physical shell, but even after destruction, it will not cease to exist as long as the code is there, as long as the program remains – it can be used forever, constantly improving. For example, you can use them to deal with harmfulness. Robots are excellent workers at nuclear power plants, radiation does not harm them, and they can be located in minimal accessibility from the units, because they are not susceptible to high temperatures. They are able to carry out calculations in a matter of nanoseconds, in which case they will prevent a tragedy. They will not conduct experiments that could forever destroy living things within the radius of the city.

Physically, robots are very strong and do not know fatigue. They can be used as miners. Working in a mine is very dangerous and requires special treatment. A miner must be strong, resilient, stress-resistant, and smart. The robot has all of the above listed qualities. In the event of any incident at the mine, the robot will not be able to die or suffer – it is not alive, it will perform the functions that are assigned to it.

The most important qualities of doctors are a cool head, resistance to stress, precision of action, and enormous concentration. A robot could take on this role. The first robot to assist in surgery was Arthrobot, which was first developed and used in Vancouver in 1985. This robot assisted in manipulating and positioning the patient's leg by voice command.

In our realities, robots can also be used for military purposes. The robot is an excellent soldier: fast, strong, resilient, and secretive. He will never reveal secrets to the enemy. In the future, wars will be fought using robots. Nowadays, robots are actively used in demining our country, saving hundreds of civilians and soldiers, and reducing the risk of death for sappers.

Robots are excellent psychologists, despite the fact that they cannot sense. Unfortunately, most people do not really understand what people, who find themselves in trouble, really want and share it. They do not need notations, lectures,

jokes or advice; firstly, they want someone to simply listen to them, silently, without interrupting. Only after the person speaks out, you can calmly draw conclusions and come to a solution to the problem.

References:

1. First robot in history (2023)

[https://ru.wikipedia.org/wiki/Da_Vinci_\(%D1%80%D0%BE%D0%B1%D0%BE%D1%82-%D1%85%D0%B8%D1%80%D1%83%D1%80%D0%B3\)](https://ru.wikipedia.org/wiki/Da_Vinci_(%D1%80%D0%BE%D0%B1%D0%BE%D1%82-%D1%85%D0%B8%D1%80%D1%83%D1%80%D0%B3))

2. Robowash (2015-2023) <http://robowash.com.ua/>

ENERGY SAVING TECHNOLOGIES

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Energy saving technologies are at the forefront of sustainable development and environmental preservation. They play a crucial role in reducing energy consumption, thereby contributing to the mitigation of global warming (Energy Saving Trust, 2023).

The implementation of energy saving technologies has numerous benefits. It not only reduces the cost of energy for consumers but also decreases the demand for fossil fuels, leading to a reduction in greenhouse gas emissions.

Energy saving technologies encompass a wide range of solutions. These include energy-efficient appliances, renewable energy sources, smart grid technology, and energy management systems. Each of these technologies contributes to the overall goal of reducing energy consumption and promoting sustainability.

The adoption of energy saving technologies is not without challenges. It requires significant investment and a shift in consumer behavior. However, the long-term benefits far outweigh the initial costs. In addition to environmental benefits, these technologies can also lead to significant cost savings over time.

Furthermore, energy saving technologies have the potential to stimulate economic growth by creating new industries and jobs. They can also improve energy security by reducing dependence on fossil fuels (International Energy Agency, 2023).

In conclusion, energy saving technologies are an essential part of our efforts to combat climate change and promote sustainable development. By adopting these technologies, we can significantly reduce our energy consumption and contribute to a more sustainable future (World Energy Council, 2023).

References:

1. Energy Saving Trust, (2023) Energy Saving Technologies. EST. Retrieved from: <https://energysavingtrust.org.uk/>
2. International Energy Agency, (2023). Energy Efficiency 2023. IEA. Retrieved from <https://www.iea.org/reports/energy-efficiency-2022>
3. World Energy Council, (2023). World Energy Issues Monitor 2022: Energy saving technologies. WEC. Retrieved from <https://www.worldenergy.org/publications/entry/world-energy-issues-monitor-2022>

GLOBAL WARMING

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Global warming is when the temperature of the Earth's atmosphere goes up for a long time. This can cause serious problems for the land and its inhabitants.

The main cause of global warming is the release of greenhouse gases such as carbon dioxide, methane, and nitrous oxide into the atmosphere. These gases trap the sun's heat and increase the Earth's surface temperature.

Shrinking glaciers, rising ocean conditions, changing precipitation patterns, and increasing frequency and severity of extreme rainfall events. These phenomena threaten the sustainability of natural territories and human societies and can

undermine food production, thrift, and social welfare.

Global warming and air pollution can lead to breathing problems for children, the elderly, and vulnerable populations. It can also cause animals and plants to go extinct and damage the environment, which can be very bad for the environment and money.

To reduce the effects of global warming, individuals, governments, and organizations around the world must work together to reduce hothouse gas emigrations and use sustainable environmental programs. This encompasses reducing energy consumption, utilizing renewable energy, and transitioning to a diet that is more factory-based.

The future of the earth depends on collaborative sweats to address this pressing issue. Everyone needs to take responsibility and act now to decelerate the goods of global warming.

References:

Discovery Of the Greenhouse Effect - Greenhouse Gases. (2023, 2 вересня). Climate Policy Watcher. <https://www.climate-policy-watcher.org/greenhouse-gases-2/discovery-of-the-greenhouse-effect.html>

Global Warming. *Home - National Geographic Society.*
URL: <https://www.nationalgeographic.org/encyclopedia/global-warming/> (date of access: 28.10.2023).

Rethinking agriculture. *European Environment Agency.*
URL: <https://www.eea.europa.eu/publications/rethinking-agriculture> (date of access: 28.10.2023).

News For Everyone. *News For Everyone.*
URL: <https://youmenews.blogspot.com/> (date of access: 28.10.2023).

How Do We Reduce Greenhouse Gases? | Center for Science Education. (2020). Home Page | Center for Science Education. <https://scied.ucar.edu/learning-zone/climate-solutions/reduce-greenhouse-gases>

CO₂ and Greenhouse Gas Emissions. (б. д.). Our World in Data. <https://ourworldindata.org/co2-and-greenhouse-gas-emissions>

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