

CHEMICAL SCIENCES

12. **Tuychiev S. A., Togasharov A. S.** 70
STUDY OF THE RHEOLOGICAL PROPERTIES OF
[[60% $\text{NaClO}_3 \cdot \text{CO}(\text{NH}_2)_2$ + 40% H_2O] + 1.5% $\text{C}_2\text{H}_5\text{NO}$] –
 $\text{CH}_3\text{COOH} \cdot \text{NH}_2\text{C}_2\text{H}_4\text{OH}$ SOLUTION SYSTEM

TECHNICAL SCIENCES

13. **Denysov V.** 74
TECHNO-ECONOMIC CHARACTERISTICS OF WIND AND
SOLAR POWER PLANTS UNDER TRADITIONAL CONTROL
SCHEMES
14. **Lyubimova N. V., Ihlinskyi A. V.** 86
ENERGY MANAGEMENT IN BUILDINGS: DIGITAL
SOLUTIONS, RENEWABLE ENERGIES AND MODERNIZATION
OF THE EXISTING FUND
15. **Obodovych O., Pereiaslavl'tseva O., Stepanova O., Chernyavsky K., Sheiko T.** 90
METHOD OF CALCULATING THE GRANULOMETRIC
COMPOSITION OF A GRAIN MIXTURE DURING DISPERSION IN
A ROTARY-PULSATION APPARATUS
16. **Горбань Ю. В., Борисова К. Є., Лашко О. О., Тімошин А. С.** 97
ФІШИНГ ЯК ОДНА З НАЙПОШИРЕНІШИХ ЗАГРОЗ У
ЦИФРОВОМУ СЕРЕДОВИЩІ
17. **Дурєєв В. О., Олійник В. В., Бондаренко С. М., Антошкін О. А., Малярів М. В., Дерев'яно О. А., Закарлюка А. П.** 100
ФУНКЦІОНАЛЬНА МОДЕЛЬ ШИРОТНО-ІМПУЛЬСНОЇ
МОДУЛЯЦІЇ ВИКОНАВЧОГО ПРИЛАДУ ПРИЛАДУ
АДАПТИВНОЇ СИСТЕМИ ПРОТИПОЖЕЖНОГО ЗАХИСТУ
18. **Здановський В. Г.** 105
ДОСЛІДЖЕННЯ ВЗАЄМОЗВ'ЯЗКУ ВИРОБНИЧИХ РИЗИКІВ І
ТРАВМАТИЗМУ
19. **Каранда В. С., Банник В. В., Банник Н. Г., Кабат О. С.** 113
ДОСЛІДЖЕННЯ КОРОЗІЙНОГО РУЙНУВАННЯ ОБЛАДНАННЯ
ХАРЧОВИХ ВИРОБНИЦТВ У КИСЛИХ СЕРЕДОВИЩАХ
20. **Курбиязов Дилшодбек Куёанышбай улы, Алланиязов Д. О., Реймов А. М., Эркаев А. У., Тажибаев Т. А., Очилов Сиродж Уразбой улы** 116
ХАРАКТЕРИСТИКА БЕНТОНИТОВОЙ ГЛИНЫ
КРАНТАУСКОГО МЕСТОРОЖДЕНИЯ, И ЕЁ ФИЗИКО-
ХИМИЧЕСКОЕ ИССЛЕДОВАНИЕ
21. **Перетяка С. М.** 121
ПРИЧИНИ СПАЛАХІВ ІНФЕКЦІЙНИХ ЗАХВОРЮВАНЬ НА
КРУЇЗНИХ СУДНАХ

ENERGY MANAGEMENT IN BUILDINGS: DIGITAL SOLUTIONS, RENEWABLE ENERGIES AND MODERNIZATION OF THE EXISTING FUND

Lyubimova Natalia Volodymyrivna

Senior Lecturer

Ihlinskyi Anton Valeriiovych

student

Kyiv National University of Technologies and Design

Kyiv, Ukraine

Abstract: In today's world, the construction sector is responsible for a significant part of energy consumption and CO₂ emissions. Old residential and commercial buildings often have high heat loss and inefficient lighting systems, which leads to increased energy consumption. digital technologies (IoT), monitoring systems, artificial intelligence (AI) and other modern energy-saving technologies, you can find a special approach for each such building. Through the comparison of parameters such as lighting and the analysis of digital control systems, it is evaluated which combination of changes gives a sufficiently high effect, as well as what obstacles and challenges exist on the way to upgrading an old house to a "smart" one. The result is a demonstration that an integrated approach can provide significant energy savings and a reduction in carbon footprint.

Keywords: Energy management, modernization, energy efficiency, residential buildings, smart home, LED technologies.

Entry. The problem of excessive electricity consumption in the residential sector is becoming especially relevant due to the increase in tariffs for heating, water supply and sewerage and electricity, environmental challenges due to climate change, as well as Ukraine's European course towards energy independence. Based on data from the International Energy Agency (IEA, 2023), about 30-40% of total energy consumption is accounted for by buildings. In fact, 1/3 of the world's energy, that

humanity produces, falls on houses. Therefore, this creates the need for the introduction of effective energy management systems [1].

The purpose of the work is to study modern approaches to the implementation of energy management in residential buildings, to identify problems and challenges that will arise during the modernization of the old housing stock, and to analyze promising technologies for improving energy efficiency.

Main part. LED lamps. One of the simplest, cheapest and at the same time the most effective measures is the usual replacement of outdated lighting with LED lamps. So, if we compare incandescent lamps, which consume about 60 W on average, with modern LED counterparts, they provide an equivalent luminous flux with a fairly small consumption – only 8 - 10 W. This will significantly reduce lighting costs by 6 - 7 times, as well as reduce the load on the power system [2].

"Passive Houses". After the end of the war, the reconstruction of Ukraine is relevant, so it will be necessary to build energy-efficient houses. And such a promising direction is the creation of the so-called "passive houses". Their name is that due to thermal insulation, tightness and the use of energy sources, minimal consumption of heat and electricity is achieved. According to European standards, such buildings will consume 10 times less energy than traditional ones [3].

Modernization. A particularly important task for our country is the modernization of the old housing stock, because most of the houses were built in the Soviet period and do not meet modern standards. Having analyzed a large number of such buildings, specialists took such basic measures as: insulation of facades, integration of systems for monitoring resource consumption, installation of individual heating points, etc. [4].

"Smart Technology". The introduction of "smart technologies" is a fairly new trend that allows building occupants to monitor energy, heat and water consumption in real time through special applications. For example, if you take smart pipe systems, they are able to monitor the pressure level and temperature of water in the system, leaks or some other problems that need to be solved immediately. They can also analyze heat consumption and automatically adjust the supply of resources. This

not only reduces bills, but also reduces bills, but also greatly increases the comfort of living [5].

Nanotechnology. A new field of science (nanotechnology) allows, thanks to the deposition of nanoparticles of one material on another, to change its properties. And this opens up new opportunities for improving the energy efficiency of buildings. The use of nanomaterials in thermal insulation, the use of nanostructured photovoltaic cells, nanocoatings for windows and facades, such as, for example, Aeropan nanopanels in walls, perovskite solar panels or quantum dots and nano-PCM in window glass, makes it possible to reduce the heat consumption, increase the efficiency of solar panels, ensure the durability of structures, and in combination with smart technologies, will allow you to regulate heat intake through walls and windows, while maintaining a comfortable temperature for the resident. This approach contributes to reducing energy consumption, reducing carbon dioxide emissions and developing sustainable technologies in construction [6].

Problems. There are many problems that will make it quite difficult to make the building energy efficient. These include:

- High cost of the latest systems and materials, which can be economically unprofitable on a large scale
- The complexity of modernizing old buildings that are not always technically adapted to such changes and may not be subject to modernization
- Cybersecurity in cases of IoT solutions, because it is problematic to write appropriate software for such systems in order to have a small chance of a hacker attack threat
- Environmental risks associated with the use of nanoparticles, since scientists have not yet learned how to track them in the environment, and this is why nanoparticles are dangerous – because of their small size
- Lack of uniform standards and legislative framework for integrated energy management. With the existence of a universal protocol, it would be possible to achieve faster and cheaper upgrades, but without it, specialists have to spend a lot of time and money on the selection of tasks to create energy efficiency of the building

Conclusions. Energy management in the residential sector is a key factor in the transition to sustainable energy, and the most effective areas are:

- Replacement of outdated lighting systems with LED technology
- Construction of new energy-efficient houses using the principles of "passive house"
- Modernization of old buildings through automation, insulation and implementation of monitoring systems
- Application of "smart" technologies and nanotechnologies to optimize energy consumption

Further development of this area will require an integrated approach and innovative solutions that will combine state support programs, modern technologies, as well as the consciousness of consumers themselves.

LITERATURE:

1. International Energy Agency. *Energy Efficiency 2023*. Paris: IEA, 2023. Source: <https://www.iea.org/reports/energy-efficiency-2023>
2. Philips Lighting. *LED Lighting: Energy Savings and Environmental Benefits*. Amsterdam, 2022. Source: <https://www.usa.lighting.philips.com/consumer/led-lights>
3. Passive House Institute. *Passive House Basics*. Darmstadt, 2021. Source: https://passiv.de/en/02_informations/02_passive-house-requirements/02_passive-house-requirements.htm
4. Держенергоефективності України. *Щорічна доповідь про стан енергоефективності у житловому секторі*. Київ, 2022. Source: <https://saee.gov.ua/dialnist/enerhoefektyvnist/enerhoefektyvnist>
5. UN-Habitat. *Global Status Report for Buildings and Construction*. Nairobi, 2022. Source: https://unhabitat.org/sites/default/files/2022/06/wcr_2022.pdf
6. Soleymani M., et al. *Nanotechnology for Thermal Comfort and Energy Efficiency in Educational Buildings*. Scientific Reports, 2024/ Source: <https://www.nature.com/articles/s41598-024-72852-7>