burden on companies and government policy regarding the provision of imported or reserve resources. Therefore, ensuring the economic security of strategic enterprises in the oil and gas sector should be a priority of state energy policy. This requires the implementation of a systematic approach that combines economic, managerial, institutional, and security aspects.

References

1. Hlushko, A. (2024). Strengthening energy security of Ukraine. *Economics and Region*, (3(94), 157–163. https://doi.org/10.26906/EiR.2024.3(94).3494

2. Onyshchenko V., Vynnykov, Y., Shchurov, I., Kharchenko, M. Case Study: Sites for the Drilling and Repair of Oil and Gas Wells. In: Onyshchenko, V., Mammadova, G., Sivitska, S., Gasimov, A. (eds) Proceedings of the 4th International Conference on Building Innovations. ICBI 2022. Lecture Notes in Civil Engineering. Springer, Cham. 2023. Volume 299. P. 367–389. https://doi.org/10.1007/978-3-031-17385-1_30

3. Association of Gas Producers of Ukraine. What did 2024 bring for Ukrainian gas production? URL: https://www.agpu.org.ua/en/news/association-s-news/what-did-2024-bring-for-ukrainian-gas-production

4. Underground Storage. URL: https://utg.ua/en/utg/gas-transportation-system/underground-gas-storage.html

5. Gas storage in Ukrainian UGS exceeded 7 bcm. URL: https://expro.com.ua/en/tidings/gas-storage-in-ukrainian-ugs-exceeded-7-bcm

UDC 504.06:004.738:502.2

Alona Buriak
PhD (Economics), Associate Professor
National University “Yuri Kondratyuk Poltava Polytechnic”

DIGITALIZATION IN ENSURING ENVIRONMENTAL SAFETY OF INDUSTRIAL AND NATURAL ECOSYSTEMS

In contemporary conditions, industrial and natural ecosystems face increasing challenges due to the intensification of human activity, technological transformations, and global environmental changes. The integration of digital technologies into environmental management has emerged as a strategic tool for ensuring sustainable and safe ecosystems. Digitalization enables real-time monitoring, predictive analytics, and more efficient decision-making processes that mitigate ecological risks and enhance the resilience of both natural and industrial systems.

Industrial ecosystems are particularly vulnerable to environmental threats arising from pollution, resource overexploitation, and technological accidents. Natural ecosystems, in turn, face risks associated with climate change, biodiversity loss, and human-induced disturbances. In this context, the

development and implementation of innovative digital tools and platforms are crucial for maintaining environmental safety and achieving sustainable development goals [1, p. 181–182].

Digitalization introduces new methodologies for monitoring and managing ecological risks. The use of digital sensors, Geographic Information Systems, Internet of Things devices, and predictive modeling allows stakeholders to assess environmental hazards with high accuracy and respond proactively. These technologies not only improve data collection but also facilitate multi-level analysis of environmental threats, from local industrial sites to broader regional ecosystems.

Moreover, the introduction of digital solutions in industrial risk management facilitates predictive maintenance and accident prevention. Advanced analytics and machine learning models can forecast potential equipment failures or hazardous events, providing decision-makers with actionable insights. By minimizing environmental incidents, industrial actors contribute to the broader ecological stability of surrounding natural systems [2, p. 35–45].

Furthermore, digital platforms can foster cross-border cooperation for environmental protection. By integrating data from multiple countries or regions, policymakers and researchers can track transboundary ecological processes, coordinate interventions, and share best practices. Such collaboration is particularly relevant in the context of climate change and global biodiversity management.

Beyond technical solutions, environmental safety also depends on effective stakeholder communication and conflict resolution. Digital platforms facilitate mediation between industrial actors, local communities, and governmental authorities, allowing for consensus-based decision-making and dispute resolution. For example, in tourism regions affected by environmental stress, digital mediation tools can help balance ecological preservation with economic activities, including emerging sectors such as dark tourism [3].

International experience demonstrates that countries actively integrating digital technologies in environmental management achieve better ecological outcomes and higher compliance with international standards. For instance, the European Union has implemented comprehensive digital monitoring frameworks for industrial emissions, water quality, and biodiversity conservation. These systems allow for early warning of ecological hazards and facilitate evidence-based policy-making.

Digitalization is a transformative force in ensuring environmental safety for both industrial and natural ecosystems. By integrating real-time monitoring, predictive analytics, and stakeholder mediation practices, digital technologies provide comprehensive mechanisms for risk management, conservation, and sustainable development.

In conclusion, the adoption of digital technologies in environmental management represents a strategic priority for national and international

policymakers. By combining technical innovation with participatory governance, states can ensure ecological safety, support sustainable economic activities, and strengthen the long-term resilience of both industrial and natural systems.

References

1. Буряк А.А. Пріоритети ОНН у напрямі удосконалення міжнародної інформаційної безпеки. *Сталий розвиток: виклики та загрози в умовах сучасних реалій: матеріали II Міжнародної науково-практичної Інтернет-конференції*, 06 червня 2024 р. Полтава: Національний університет імені Юрія Кондратюка, 2024. С. 181–182. https://reposit.nupp.edu.ua/bitstream/PoltNTU/17032/1/9.pdf

2. Maslii, O., Buriak, A., Chaikina, A., & Cherviak, A. (2025). Improving conceptual approaches to ensuring state economic security under conditions of digitalization. *Eastern-European Journal of Enterprise Technologies*, *1*(13 (133), 35 – 45. https://doi.org/10.15587/1729-4061.2025.319256

3. Буряк А.А., Левченко І.В., Маховка В.М., Борисенко К.О. Сутність «темного» туризму як перспективного напряму розвитку туристичних дестинацій: міжнародний досвід. *Ефективна економіка*. 2022. № 10. URL: https://nayka.com.ua/index.php/ee/article/view/661. DOI: http://doi.org/10.32702/2307-2105.2022.10.25

УДК 621.74.01

Єфименко Назар Олександрович
аспірант, Національний університет «Запорізька політехніка»

СУЧАСНІ МЕТОДИ ДЕСУЛЬФУРАЦІЇ З ВИКОРИСТАННЯМ ІНДУКЦІЙНИХ ПЕЧЕЙ

Десульфурація є одним із ключових процесів металургійного виробництва, що визначає якість сталі та сплавів. Зниження вмісту сірки сприяє покращенню пластичності, ударної в'язкості та зварюваності металів. Традиційні методи десульфурації здійснюються переважно у конвертерах або дугових печах, однак сучасна тенденція розвитку металургійних технологій спрямована на впровадження індукційних печей, які поєднують високу енергоефективність і точність контролю процесу [1, с. 52].

Індукційні печі створюють умови для рівномірного нагріву розплаву та інтенсивного електромагнітного перемішування, що забезпечує ефективний масообмін між металом і шлаком. Основний механізм десульфурації полягає у взаємодії сірки, розчиненої в металі, з основними компонентами шлаку, переважно CaO, з утворенням стійких сульфідів кальцію. Залежно від складу шлакової системи, застосовують флюси на основі $CaO–Al_2O_3–$