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Peculiarities of Insurance of Subjects of the Closed Cycle Technology Sphere

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Abstract. The urgency of the declared subject of scientific research is conditioned by the existence of many problems in the protection of property interests at realization of technologies of a closed cycle. This is especially important for Ukraine, where closed cycle technologies are only introduced into the national economy and do not comprise the significant part of the state's gross domestic product. The purpose of this research is to study the prospects of protection against adverse risks, which may arise during the implementation of the closed cycle technology, due to the transfer of risks to insurance. The basis of methodological approach in this research article is a qualitative combination of methods of system analysis of the possibility and expediency of risk insurance at realization of the technology of closed cycle and research of the quality of insurance protection, assortment of available insurance products, which can cover risks inherent to subjects of realization of closed cycle technologies, and thus prospects of development of such kind of insurance. The main results obtained in this scientific research are the determination of the possibility and quality of insurance protection for the subjects of closed cycle economy, as well as the formulation of problems, logistics and ways of improving insurance of subjects of sphere of realization of closed cycle technologies. The results of this research, as well as the conclusions drawn from them, are significant both for the employees of the closed cycle technology sphere, who will be able to assess the possibility and process of insurance risks that may arise during the period of their activity and for insurance companies on the basis of this research, that have the desire to diversify the insurance portfolio and to add Agreements with representatives of the sphere of realization of closed cycle technologies

Keywords: closed cycle technology subjects, green technologies, insurance, prospects for the development of closed cycle technology subjects, insurance products



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INTRODUCTION

Today, there is a need to increase the share of closed cycle technologies in the general production both in Ukraine and in the whole world, since the constant use of natural resources has a negative impact on the environment (Babbitt *et al.*, 2021). Already in Ukraine are identified such ecological problems as increase of risks for human health, connected with almost all kinds of hydrometeorological phenomena; significant decrease of harvest of the main agricultural crops; aggravation of problems with water supply not only in Southern and South-Eastern regions; intensification of soil degradation and desertisation; reduction of productivity, viability and sustainability of forests; accelerated degradation of ecosystems; occurrence of accidents and unstable functioning of electric networks and centralized heating systems, other infrastructure facilities, and many others (Ministry of Energy and Environmental..., 2020). There are already some steps made by the state to develop a legal and regulatory framework for the operation of closed cycle technologies in Ukraine. One of the most important normative legal documents is the Law of Ukraine "On the Electricity Market" dated April 13, 2017 (Hamburg, 2020). This Law changed the state's approach to green energy and gave the impetus to open a number of enterprises specializing in the processing of different kinds of waste energy resources, which is already consumed by the population of our country.

According to Y. Geng *et al.* (2019), insurance is one of the components for the introduction of any green technologies in the national economy all over the world, and Ukraine is not an exception. In order to procure a loan to create a closed cycle production, any bank or other financial institution will require the conclusion of an insurance contract to protect against risks that may occur in the production of green energy or processing of raw materials. In the paper by I. Markevich and V. Sidenko (2019), the researchers asserted that insurance was required for different kinds of risks, both from political uncertainty of the state, which could cause break in production or decrease financing of the enterprise, and to have been responsible for damage to the environment, as a result of use of dangerous substances and materials. A. Herrera *et al.* (2021) believed that the main type of insurance that was necessary for the implementation of closed cycle technologies was property insurance, since enterprises engaged in processing raw materials, producing green electricity and other green economy often operated the expensive equipment. According to D. Bogdanov *et al.* (2021), in order to find optimal insurance protection, it is necessary to analyze the range of available insurance products offered for protection against risks inherent in closed cycle technologies. The results of their research claim that the main criteria should be a list of risks under which the Insurer assumes obligations, exclusion from insured accidents and other limitations

of insurance, the price of insurance (or insurance tariff), reliability and reputation of the Insurer.

V.V. Dima (2020) admitted that insurance could become one of the most important financial instruments that would promote the development of closed cycle technologies. Z.-A. Ismail (2020) thinks that due to insurance, the risks of adverse events that may occur during the production period can be significantly reduced and thus stimulate enterprises to develop their activities in this field without looking at risks that may negatively affect their economic status, and investors will invest in the development of closed cycle technologies. The results of this scientist's research show that all of this can help to develop the sphere of closed cycle technologies in Ukraine considerably. According to B. Lin and R. Bai (2022), insurance gives a large number of advantages for the development of enterprises, including those working in the sphere of closed cycle technologies. However, these researchers believe that a few such companies in Ukraine apply to Insurers with the aim of protecting themselves from risks because of unwillingness to spend spare money.

The results of A.V. Thakor's (2020) research confirm the fact that insurance offers protection to companies that are not prone to risk taking from a wide range of risks, including damage to property, liability risks and financial risks inherent in closed cycle technology. However, despite its theoretical and practical utility, according to the opinion of individual and legal persons, Insurance contracts may not fulfill their duties, and the money spent on insurance protection will only be calculated in the expenses of the enterprise. According to D.H.B. Phan *et al.* (2020), the reasons of distrust include the inability of some Insurers to fulfill their obligations as a result of the low financial stability of many Insurers in Ukraine. One of the Ukrainian scientists who studied the problems of the insurance market of Ukraine, C. Haddad, L. Hornuf (2019) defines the financial stability of an insurance company as its ability to improve or not worsen the value of its performance indicators for changing factors. Therefore, the financial situation will be stable if the company can improve or not worsen the value of its performance indicators for the change of factors. At present, not all Insurers of Ukraine meet this point, because their financial condition and capacity to fulfill their obligations raise questions in any unsatisfactory situation on the market for the company. That is why the problem of insurance of closed cycle technology subjects should be raised to prove the effectiveness of insurance and the development of the correct insurance culture in enterprises working in this field.

The purpose of this research is to study the prospects of protection against adverse risks, which may arise during the implementation of the closed cycle technology, due to the transfer of risks to insurance.

MATERIALS AND METHODS

The basis of methodological approach in this research is a qualitative combination of methods of system analysis of insurance products that can cover risks of enterprises working in the sphere of technologies of closed cycle. The basis of such analysis is the insurance tariff, insurance conditions, exclusion and limitation of insurance, which is offered in accordance with insurance product documentation and reliability and reputation of the Insurer offering the insurance product. The theoretical basis of this research is the results of the carried-out researches of a number of Ukrainian and foreign researchers aimed at studying a number of problems connected with the possibility of protection of enterprises working in the sphere of closed cycle technologies against risks that may occur during the operation of such an enterprise.

The research was presented in three main stages. At the first stage of the scientific research, its theoretical base was prepared, which described the specifics of closed cycle technologies to explain the risks inherent in this type of production, and the specifics of closed cycle technology subjects' insurance, namely, the sources of risk, the method of tariff calculation and possible limits of insurance inherent for this type. At the second stage of scientific research, the analysis of prospects of insurance of closed cycle technology subjects is carried out. Analyzed insurance products that can meet the insurance interests of closed cycle technology subjects, their insurance conditions, exclusion and limitation of insurance. After analysis of insurance products, the product is chosen, which can be considered the most qualitative and effective for protection against risks inherent to the subjects of the closed cycle technology sphere. Each product is separated by both its positive and negative sides, which may influence the final choice of the Insurer.

At the final stage of the research, on the basis of the results obtained during its study, final conclusions of the scientific research, which form the aggregate picture, concerning the market of insurance of the closed cycle technology subjects were formulated. In particular, there are list of problems that prevent the growth of this segment of the insurance market and protection of closed cycle technology subjects from the risks inherent in this sphere. After the formulation of the problems, ways that could change the state of the insurance market of closed cycle technology subjects and improve the protection of enterprises working in this sphere were proposed.

RESULTS AND DISCUSSION

Closed cycle technology is a concept based on the idea to reuse materials to create new products. If in the usual, linear economy the majority of the natural resources extracted are passed into wastes which are recovered soon, then in the cyclic – any resources are used as long as possible, after which they are recycled. One of the

teachers of the University of Maryland (United States of America – USA), T. Cao and Y. Hwang (2020) argue that interest in the closed cycle economy has increased due to oil crises, the depletion of open-access natural resources and environmental pollution. The concept of closed cycle technologies is combined with green and low-carbon technologies, where the central idea is to avoid fossil fuels and develop new technologies. However, in contrast to green technologies, closed cycle technologies are more specific and decide how less and more efficient to use different kinds of resources, not only those connected with electric power generation. As noted in the work written by M.T. Brouwer *et al.* (2020), the task of closed cycle technologies is to use renewable resources more widely, to carry out transition to non-waste production, to minimize damage and economic losses, which are caused to the environment through uncontrolled exploitation of mineral sources.

Closed cycle technologies are trying to introduce governments and business representatives all over the world, the most systematic – in Germany (Jiang *et al.*, 2022). For example, in Germany, one third of the total waste is for thermal utilization. The current level of development of closed cycle technologies is insufficient. They make up an average of 8.6% in world production. However, according to L. Cherchyk *et al.* (2019), to remain within the ecological potential of Earth, it is necessary to increase this indicator to 50-70%. In the production of one of the most developed countries in this sphere, Germany, the share of closed cycle technologies is only 10.4% – that is, only 10.4% of the resources were recycled materials. At the same time, progress in this direction is moving slowly. Over the past six years, growth in Germany has been only 0.1% per year. Even if the country is twice as fast, it will be able to reach 50% only by 2215. The group of scientists D. Aloin *et al.* (2020) to the good of closed cycle technologies, the arguments of both ecological and economic nature are presented. For the production of goods and services, and finally for the creation of a joint-stock value, the economy needs resources. If companies do not start using secondary raw materials radically more often, they will meet with lack of availability of resources, which will prevent their operations in the midterm and long term.

It follows that in order to maintain the ecological and economic state of the Earth, new levers of influence on the development of the closed cycle technology sphere are required. One of such levers should be insurance of the subjects of this sphere. During its activity, enterprises that introduce closed cycle technologies into their production meet with the number of risks, which are inherent both to the subjects of closed cycle technologies and in general, to all branches of economy of any state. J. Kaczmarek (2019) believes that closed cycle technology subjects can suffer from various risks, including the political uncertainty of the state, which may

cause interruption in production or decrease in financing of the enterprise, and possible liability for environmental damage, as a result of the use of unsafe substances and materials. Equally important are property risks, which may occur with equipment or real estate, which is in use of enterprises. According to D. Asteriou *et al.* (2021), the most effective and simple way to protect against the above risks is insurance, which allows covering financial consequences from any unfavorable events. Nevertheless, insurance is not always in demand among any enterprises, including representatives of the closed cycle technology sphere. The question is particularly acute in Ukraine, where the insurance culture in the population and enterprises has always been low and voluntary types of insurance are more likely rarity than a mandatory step in the course of their activities.

According to R. Kaplinsky and E. Kraemer-Mbula (2022), one of the main problems of the insurance industry, which needs to be solved is planning of long-term development of insurance companies in the conditions of increase of their reliability. This statement once again emphasizes the need to increase the reliability of Ukrainian Insurers for greater trust from potential clients. No less important reason for distrust of Insurers is the ambiguity of Agreements for consumer's part, who may not have enough financial awareness to fully understand the essence of the Agreement and its operation. This factor of mistrust was investigated by scientist R. Peter and J. Ying (2020), and concluded that most of the regulation of the insurance product is focused on the exceptions in the Contract, which are not always aware of the consumer of the insurance service, because of which there are disputes and distrust to the Insurer. Although most of the existing disputes between Insurance Companies and their clients focus on the consequences of non-fulfillment of Insurance Contracts, the probability of non-fulfillment of the Contract should be considered primarily because of insufficient awareness of the consumers of insurance services. A. Belke *et al.* (2019) asserted that knowledge in the conditions of the Contract of insurance considerably increases the probability of proper functioning of such Contract, because under conditions of awareness the Insured is able to fulfill its obligations in accordance with the conditions of the Contract and thus not to prevent the Insurer from paying a possible insurance indemnity. In addition, if realizing the exceptions and limitations that may prevent payment of insurance indemnity, the Insured will be able to avoid risks on its own, which will not be paid insurance indemnity.

Analyzing the work of M. Tanninen (2020), who has studied the prospects of insurance development on the basis of social behavior of consumers of insurance services, it can be concluded that under the conditions of greater trust, demand for insurance products, which are aimed at protection of subjects of the closed cycle technology sphere, which is beneficial for both Insurers, and for the subjects of the closed cycle technology. In

addition to the problem of trust in Insurers, there is also one of unwillingness to spend spare money on conclusion of insurance contracts. An insured event may or may not occur, it is an accidental event that cannot be influenced to a certain extent, and it is therefore impossible to predict in advance whether the conclusion of the Agreement will be justified itself or not. Thus, the enterprise risks paying a considerable amount of funds for transfer of risks to insurance, and instead get nothing. But A. Ajello *et al.* (2019) noted that in most cases, the subjects of the closed cycle technology sphere would not receive any insurance indemnity, and the insurance expenses would look like burden in the articles of expenditure of the enterprise. However, if an event could be considered as an insurance and not conclude an insurance contract, the enterprise risks receiving the number of losses that may be more significant than the insurance premiums for several years that the enterprise could pay. This problem of decision making or attempts to avoid risk was investigated by T. Heinrich and J. Shachat (2020), and on the basis of their research it is possible to understand, that the way of avoiding risk by the enterprise should not be a norm, because on probability of hypothetically losing more significant amount of funds in the future, or to spend less significant amount of funds here and now both individual and legal persons have to choose the second option.

Analyzing one of works written by J. Knighton *et al.* (2020), interesting regularity can be seen: when the development of technologies of a closed cycle (an important instrument of its implementation should be insurance) significantly reduces the risks of natural disasters arising from ecological problems of our planet. By allowing this regularity, it makes sense to study the National flood insurance program (NFIP) records in the USA about flood insurance that provide information about historical risks of floods and the relationship between danger and risks. Over the past few decades, participation in the NFIP has steadily increased to approximately 5 million houses, with an annual record of an average of 60000 insured cases from floods, which is a significant indicator, since almost every 80-th house suffers from flooding. The problem of frequent realization of risks of flooding is just to solve the development of technologies of a closed cycle, according to the discovered regularity which was investigated by J. Knighton *et al.* (2020). However, it should be taken into account that economic barriers and failure to perceive the risk of housing owners may reduce the participation of housing owners in the NFIP, which may change the reliability of insurance indemnity statistics as an unbiased picture of historical data (Song & Wang, 2020).

Thus, for example, regarding the statistics of flooding in the USA, it can be argued that the number of insured events associated with such risks can be significantly reduced. Scientists from the USA, L.A. Bakkensen and L. Ma (2020) confirm this assumption in one of their

scientific works, which also confirms the risk mitigation of natural phenomena worldwide. This, in turn, will reduce the loss of such types of insurance, which will positively affect the financial results of Insurers all over the world. Also, if environmental risks are reduced, insurance tariffs for many types of insurance, such as property insurance, vehicle insurance, environmental liability insurance, etc. will be significantly reduced (Beirne, 2020). This will affect the price reduction of insurance services worldwide, because insurance, as a method of risk avoidance, will become more accessible and thus more common for both individual and legal entities. However, with a significant reduction in environmental risks in the world, such types of insurance as flood insurance and other types of insurance associated with environmental risks may become unnecessary to the population and enterprises, although now insurance is used as the main method of covering risks in the flood, as noted by Australian scientists C.H. Lucas and K.I. Booth (2020).

It is necessary to evaluate those insurance products that can protect against risks inherent to the subjects of the closed cycle technology sphere and developed by Ukrainian Insurers. It makes sense to evaluate their insurance conditions, exclusion and limitation of insurance and choose a product that can be considered the most qualitative and effective for protection against risks inherent to the subjects of the closed cycle technology sphere. For analysis the best choice will be insurance of objects of green energy. In Ukraine there are 2 main products developed specifically for the insurance of green energy objects, namely the products "Insurance of solar power stations" from insurance company "Persha" and "Insurance of green energy objects" from insurance company "INGO". It is necessary to note that if the first product is specialized only on solar power, the second product is more universal and more suitable for the subjects of the closed cycle technology sphere. In general, it is possible to ensure objects of green energy and at another insurance companies of Ukraine, but on the terms of insurance products on property insurance, because the special insurance products for green energy objects insurance were not developed by these Insurers. In the product "Insurance of solar power stations" from insurance company "Persha" Insurance consists of four blocks:

1. Block A – insurance of building and construction works for solar power station construction. The insurance coverage begins with "zero cycle" or erection of foundation blocks and continues until the plant is put into operation.
2. Block B – third party liability insurance.
3. Block C – shipment insurance of solar panel. Solar panels are very fragile commodity; therefore, the Insurer strongly recommends to additionally insure their transportation on the whole way of shipment.
4. Block D – insurance of the solar power station as a property complex, after completion of construction and putting into operation (property insurance).

This product has no limitations of insurance or exclusions, therefore it can fully protect the subjects of green energy at all stages of their activity from the beginning of construction of solar "farm", from the moment of erection of foundation blocks, to the stage of main activity of "farm", i.e., electric power generation. At the same time, it is quite convenient that insurance consists of four blocks, and the Insurer can personally choose protection from those risks that he/she considers necessary. For example, if the Insurer is sure that the risks of damage or destruction of solar panels during shipment are minimal, and the course of shipment of expensive equipment is fully controlled by them, they can refuse from this block and save money and thus will reduce the cost of insurance for the enterprise. Insurance company "INGO" offers to the Insurer some other conditions. Insurance is divided into four blocks:

1. Block 1 – insurance of building and construction works at any stage of building activity.
2. Block 2 – liability insurance, which may arise during the basic activity of the enterprise, to third parties.
3. Block 3 – interruption insurance.
4. Block 4 – risk insurance against damage or destruction of property, which may occur during the enterprise activity.

In general, both products have a convenient system of choice of insurance program by blocks, which improve quality. However, each product does not have at least one important insurance block. The product "Insurance of green energy objects" from insurance company "INGO" has no block on the property insurance of the green energy subject against damage or destruction during shipment, and the product "Insurance of solar power stations" from insurance company "Persha" has no block on the interruption insurance. However, interruption insurance is more important for enterprises working in the sphere of closed cycle technologies, as it was noted by representatives of this sphere there are political risks in this sphere, especially in Ukraine. The problem is that at present, green electricity generation has a higher cost. Accordingly, due to the high price of green electricity compared to the prices for electricity generation, the traditional methods may be limited at any moment. That is why the product "Insurance of green energy objects" from insurance company "INGO" can be considered more qualitative and more appropriate for protection of property interests of the subjects of the closed cycle technology sphere. Also, in favor of this product is its universality, thanks to which it is possible to ensure objects of enterprises, which use any green technologies for production of pure electric power, not only electric power generation due to operation of solar panels.

The scientists S. Giglio *et al.* (2021) note the problems that caused the undeveloped insurance of closed cycle technology of the subjects in Ukraine. The main problem of this type of insurance development is extremely low demand for it. In general, almost all

types of insurance are in low demand and this situation is observed during the entire period of existence of the insurance market in Ukraine. However, such kind of insurance as insurance of the subjects of the closed cycle technology sphere that demand is minimal, which can be evidenced by the extremely low number of developed insurance products for this type of insurance. Research group K. Hu *et al.* (2021), assume that the main problem for the development of all types of insurance existing in Ukraine, including insurance of closed cycle technology subjects, is extremely low solvency of both individual and legal persons. Enterprises working in the sphere of closed cycle technologies do not have enough funds to spend them on additional methods of protection against risks, one of which is insurance. According to Y.-B. Chiu and C.-C. Lee (2019), the very important problem is the low offer for this type of insurance, namely the small amount of insurance products developed for the subjects of the closed cycle technology. All this makes the unreliability of many Insurers of Ukraine even more difficult due to the offer look like too weak for closed cycle technology subjects to have a high desire to insure their risks. For this purpose, insurers should develop more insurance products for this prospective type of insurance. However, due to the low level of development of closed cycle technologies in Ukraine, Insurers do not expect to receive a large number of insurance premiums, so they do not want to spend human and financial resources on development of new insurance products. Therefore, due to the low development of this sphere in Ukraine, the growth of the offer of such kind of insurance as insurance of the subjects of the closed cycle technology sphere is unlikely.

CONCLUSIONS

It was researched that the development of insurance of the subjects of the closed cycle technology sphere

would depend directly on the participation of the state and Insurers in this process. It was noted that for development of this type of insurance, efforts of all participants of the insurance market should be attracted. On the part of the state there should be the most incentive to insurance for enterprises working in the sphere of closed cycle technologies. Such an incentive may look like compensation of the part of the insurance cost for these enterprises. Therefore, enterprises will be able to ensure their risks and have a better chance of successful existence and development, and the state will get another developed branch in the economy, which can become a significant part of the state's gross domestic product. Also, it was confirmed that under the condition of the consumer's awareness of insurance services under the conditions of the Contract of insurance the trust to Insurers would increase considerably.

It was established that the insurers themselves should develop new insurance products, which might be interested in terms of the subjects of the closed cycle technology sphere and significantly increase competition in the market of this type of insurance. However, to motivate Insurers first, it is necessary to increase the demand due to the compensation of part of the insurance cost. It was determined that in the long-term period of insurance of the subjects of the closed cycle technology sphere has all chances for successful development taking into account the development of the entire insurance market of Ukraine. All this will significantly improve the development of the closed cycle technologies and insurance in Ukraine. Thus, it is possible to confirm that under the condition of global insurance of subjects of the closed cycle technologies sphere and further development of such technologies, in the future the nature of risks of individual and legal persons, and accordingly the insurance sphere as a whole, will change considerably.

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Особливості страхування суб'єктів сфери технологій замкнутого циклу

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Анотація. Актуальність заявленої тематики наукового дослідження зумовлюється наявністю безлічі проблем у захисті майнових інтересів при реалізації технологій замкнутого циклу. Особливо актуально це є для України, де технології замкнутого циклу лише впроваджуються в національну економіку та ще не є вагомою часткою у ВВП держави. Метою даної науково-дослідної роботи є вивчення перспектив захисту від несприятливих ризиків, що можуть виникати при реалізації технологій замкнутого циклу, завдяки передачі ризиків на страхування. Основу методологічного підходу в цій науково-дослідній роботі складає якісне поєднання методів системного аналізу можливості та доцільності страхування ризиків при реалізації технологій замкнутого циклу та дослідженням якості страхового захисту, асортименту наявних страхових продуктів, що можуть покрити ризики, притаманні суб'єктам реалізації технологій замкнутого циклу, а отже й перспектив розвитку такого виду страхування. Головними результатами, які були отримані в рамках цього наукового дослідження, є визначення можливості та якості страхового захисту для суб'єктів економіки замкнутого циклу, а також формулювання проблематики, логістики та шляхів покращення страхування суб'єктів сфери реалізації технологій замкнутого циклу. Результати цього наукового дослідження, а також сформульовані на їх основі висновки, мають суттєву значимість як для працівників сфери технологій замкнутого циклу, які на основі цього дослідження матимуть змогу оцінити можливість та процес страхування ризиків, що можуть виникнути в період їх діяльності, так і для страхових компаній, що мають бажання диверсифікувати страховий портфель та додати в нього Договори, укладені з представниками сфери реалізації технологій замкнутого циклу

Ключові слова: суб'єкти сфери технологій замкнутого циклу, зелені технології, страхування, перспективи розвитку страхування суб'єктів сфери технологій замкнутого циклу, страхові продукти