Security of Energy Interests of Ukrainian Enterprises: Role of Personnel Innovative Competencies, Public Administration and Exchange Trade

MISHCHUK IEVGENIIA
Department of Accounting, Taxation, Public Management and Administration
Kryvyi Rih National University
11 Vitaliy Matusevych Str., Kryvyi Rih, 50027
https://orcid.org/0000-0003-4145-3711
UKRAINE

BONDARCHUK OLGA
Department of Enterprise Economics, Organization and Management of enterprises
Kryvyi Rih National University
11 Vitaliy Matusevych Str., Kryvyi Rih, 50027
https://orcid.org/0000-0001-9366-2019
UKRAINE

RIABYKINA NATALIIA
Department of Enterprise Economics, Organization and Management of enterprises
Kryvyi Rih National University
11 Vitaliy Matusevych Str., Kryvyi Rih, 50027
UKRAINE

RIABYKINA YEKATERYNA
Department of Enterprise Economics, Organization and Management of enterprises
Kryvyi Rih National University
11 Vitaliy Matusevych Str., Kryvyi Rih, 50027
https://orcid.org/0000-0001-7747-558X
UKRAINE

MATKOVSKYI PETRO
Department of Accounting and Taxation
Vasyl Stefanyk Precarpathian National University
57 Shevchenka Str., Ivano-Frankivsk, 76018
UKRAINE

TKACHENKO SERGII
Department of Mechanics
Zaporizhzhia Polytechnic National University
64 Zhukovsky Str., Zaporizhzhia, 69063
https://orcid.org/ 0000-0002-3798-5902
UKRAINE

ROZHENKO OLEKSANDRA
Department of Civil and Commercial Law
Donetsk State University of Internal Affairs
21 S. Tilgyi Str., Kryvyi Rih, 50065
https://orcid.org/0000-0002-9358-5436
UKRAINE

KORNUKH OKSANA
Department of Finance of Business Entities and Innovative Development
Kryvyi Rih National University
11 Vitaliy Matusevych Str., Kryvyi Rih, 50027
https://orcid.org/0000-0001-8742-2852
UKRAINE

Abstract: - The article proposes a methodology for assessing the state of security of energy interests of enterprises. In order to apply this methodology, security of energy interests is split into two components: security of energy efficiency and that of energy supply. Indicators and their corresponding liminal values are set for each of the components. A feature of the proposed assessment methodology is that it takes into account the speed at which actual security indicators can reach their liminal value. Application of the methodology allows us to conclude about the need for managerial intervention, decision-making and taking appropriate measures to improve security of energy interests as a whole and its individual components. The calculations conducted reveal that the actual indicators of energy supply security in 2018-2019 were equal to 1 at all mining enterprises of Ukraine. According to the value interpretation scale developed in the study, this value means that the state of security of energy supply was excellent (very high). In contrast, the state of energy efficiency security was not so stable and tended to deteriorate. The catastrophic state of energy efficiency security was detected at one of the mining enterprises under study, namely the PrJSC InGZK, in 2019, as the corresponding security indicator equaled zero. The obtained values of the state of security of energy efficiency are determinant for the general state of security of energy interests of the enterprises under study. In the article there are presented four directions to ensure security of energy interests of mining and metallurgical enterprises. The first direction provides for improvement of government regulation of the energy market. The second direction deals

with reorientation of the production apparatus and introduction of resource-saving technologies that are to dramatically reduce energy and fuel intensity. The third direction involves more active participation in energy exchange trading. The fourth direction consists in attracting and training employees in new competencies and professions necessary for development, introduction and implementation of innovative energy-saving technologies at the enterprises and transition to an energy business model.

Keywords: security, exchange, decarbonization, government regulation, energy interests, energy markets.

Received: May 12, 2021. Revised: March 27, 2022. Accepted: April 29, 2022. Published: May 25, 2022.

1 Introduction

The issue of energy security is interdisciplinary, quite debatable and relevant both for the country as a whole and for the individual enterprise. It is systematically raised by both scientists and practitioners in many fields: directly in energy, public administration, economics, ecology, politics, etc. [1; 2]. In the narrow sense, energy security is considered in the OSCE: as having stable access to energy sources on a timely, sustainable and affordable basis [3]. However, this definition is suitable for both energy security at the country level and the level of an individual enterprise. In a broader interpretation, energy security is viewed from two sides: the diversification of primary energy supplies and the reliability of the energy system [4]. However, at the enterprise level, in our opinion, both characteristics are one. In addition, it is necessary to add such a security feature as the efficiency of energy consumption consumed in the production of products. In this context, work is proposed to maximize economic efficiency, accelerate research into the development and implementation of advanced energy technologies, and develop science-based policies based on the realistic needs of the economy, national security and the environment to make timely decisions. coordinated with energy security goals and economic and environmental goals [5]. The problems of energy security and mitigation of climate change are inextricably linked and form complex and unstructured problems, which are described in [6]. Environmental goals are key elements in the European Union's plans: to introduce a Carbon Border Adjustment Mechanism (SWAM) shortly. It provides for the introduction of an additional tax on imports, which will take into account the "carbon footprint" in its production, reduced to a sectoral benchmark in the European Union. It is planned to take into account both direct emissions, ie those that occur directly in production, and indirect - from consumed electricity and heat. The introduction of SWAM poses significant risks for Ukraine, as the European Union is the largest importer of Ukrainian goods.

Therefore, it is important to accelerate the processes of decarbonization in Ukraine, attracting private investment, using various forms of government regulation [7].

Therefore, Ukrainian industrial enterprises need to more actively develop energy efficiency programs, pricing according to time and volume of energy consumption, as well as energy-saving programs, because these initiatives are more cost-effective than huge investments in expanding energy production capacity [8].

While this study was being carried out, the Russian Federation invaded Ukraine, which exacerbated the problem of energy security not only in Ukraine but also in many countries of the European Union. It has become clear how economically dependent and vulnerable EU countries are to imports of coal, oil, and gas from Russia. Such dependence undermines both the economic security of individual enterprises in these countries and the security of countries as a whole. Therefore, indicators of economic security of both enterprises and countries should take into account the indicators of security of energy interests, which previously did not pay attention to by researchers (for example, in [9]).

On February 24, 2022, four hours before the start of the war, Ukraine disconnected from the power systems of the Russian Federation and Belarus by the technical protocol. Synchronization with ENTSO-E allows for an increase in the capacity of networks between Ukraine and Europe to 2 GW. Therefore, the next logical step is economic synchronization and the creation of appropriate conditions for trade in Ukrainian electricity with the European Union.

From a technical point of view, Ukraine is ready to synchronize with the European electricity transmission network ENTSO-E in 2023. According to World Bank experts, synchronization will demonopolize energy markets, and ensure modernization, decarbonization, and energy independence. At the same time, the security of energy interests of Ukrainian enterprises remains significantly influenced by external and internal factors. The most significant factors of external

influence are state regulation of the energy sector and exchange trade in the energy market. Among the internal factors that should be noted is the level of innovative competencies of the enterprise staff described in [10].

Regarding external influence, we must agree with the thesis that at the present stage of public administration in Ukraine it is necessary to move from the position of libertarianism to reasonable protectionism, in particular, in the field of stock trading. This will help to highlight the economic interests of Ukrainian enterprises, among which energy interests play an important role [11].

Regarding internal factors, it should be noted that the fourth industrial revolution is causing a process of change for staff, which is involved in many areas, including those related to energy. Therefore, the staff of enterprises must be able to adapt to new technologies and related innovative and organizational changes [12].

The combination of these factors requires more careful study.

2 Problem Formulation

In 2021–2022, the Ukrainian energy complex faced one of the greatest challenges ever in the 30 years of a sovereign Ukrainian state. These challenges pose a threat to the security of the energy interests of industrial enterprises. The list of major threats includes historically low coal reserves in thermal power plant warehouses, insufficient storage of natural gas in underground gas storage facilities, high level of infrastructure deterioration, and an unprecedented financial crisis in the electricity market that affected almost all basic enterprises in the industry [13]. In the electricity generation sector, where state-owned enterprises are completely dominant, crises are most prevalent. Thus, the share of state-owned companies of the National Atomic Energy Generating Company Energoatom, PJSC Ukrhydroenergo, and PJSC Centrenergo in the production of electricity is about 70%, and with the optimal performance of the latter company,it could exceed 80%. If we take into account the fact that the state still owns the Transmission System Operator - National Energy Company "Ukrenergo", and the rules of the market are set by the national regulator National Commission for State Regulation of Energy and Utilities together with the Government of Ukraine, then the main responsible for the current crisis, analysts call the leadership of relevant government agencies and companies [13].

According to analysts from the Razumkov Research Center, the Cabinet of Ministers of Ukraine and the National Commission for State Regulation of Energy and Communal Services (abbreviated – NKREKP) show their intention not so much to introduce market mechanisms as to manually manage through regulatory price restrictions and permanent modifications trade, which has changed more than 60 times since the current model's introduction.

In addition, the imperfect system of special responsibilities distorts market principles even more [13].

All these factors threaten the security of industrial enterprises' energy interests, especially mining and metallurgical complexes, as their products are one of the most energy-intensive.

Important ways to strengthen the security of energy interests of industrial enterprises are the introduction of the latest energy-saving technologies, accelerated transition from fossil fuels to green energy. However, the insufficient level of staff qualification makes it impossible to intensify this process.

The purpose of the article is to assess the current state of security of energy interests of industrial enterprises, identify the role of public administration and stock trading and the formation of measures to improve it using innovative competencies of staff.

3 Problem Solution

3.1 Analysis of the Energy Sector of Ukraine and Problems with State Regulation

Consider the conditions of the energy market in Ukraine. It should be noted that recently there have been significant changes in the organization of the energy market, which significantly affects the security of energy interests of enterprises. The electricity market has been operating in the country only since 2019. Its structure consists of 5 segments:

- market of bilateral agreements;
- the market "for the day ahead";
- intraday market (intraday);
- balancing market;
- market of ancillary services [7].

Prices and sales volumes in each of the segments differ significantly:

1. Market of bilateral agreements. It is characterized by more stable prices than at the market "for the day ahead" with lower price volatility. Electricity is sold with delivery in a week, month, quarter, or year. It is often the largest segment of the wholesale market, reaching 70% - 80%.

2. Market "for the day ahead". It is characterized by the highest price volatility among other market

segments. It sells volumes with delivery the next day, due to which, operational news on accidents, sudden changes in demand, and the expected generation has a significant impact on market prices. However, in terms of volume, this segment occupies a much smaller share than the segment of Bilateral Agreements and is used to quickly balance expected demand and generation within 20% of daily consumption.

3. Intraday market. It is characterized by higher than the market "for the day ahead", which sell volumes with delivery within an hour, to finally close the expected imbalances of market participants. The share of the segment does not exceed 5% -10% of consumption.

4. Balancing market. It is characterized by the highest prices, as it is the final balance of generation and consumption of Ukrenergo in real-time. It should be noted that in Ukraine the distribution of prices and sales in the electricity market is significantly distorted, and differs significantly from other countries [7] (Table 1).

Table 1. Structure of electricity markets: Ukrainian and world experience

Electricity market segment	Ukraine	World experience
Market of bilateral agreements, %	60	80
The market "for the day ahead",%	36	15
Intraday market, %	1	3
Balancing market, %	3	2

Source: [7]

In Ukraine, more than 36% of electricity is sold on the organized market under state price regulation. This regulation is carried out by the National Commission for State Regulation of Energy and Utilities (abbreviated as NERC KP) (until 2023). In the conditions of functioning of the open electricity market, NERC KP has the right to set marginal prices (temporary minimum and/or maximum price limits) on the market "for the day ahead", an intraday market and balancing market for each trading area [7].

In general, provided that the pricing of products of the mining and metallurgical complex on a market basis, industrial enterprises significantly use resources (gas, electricity, fuel and energy resources), the prices of which are regulated by the state. In the medium term, this determines the degree of security of energy interests of enterprises in this market segment, and also allows the state by indirect methods (through regulation of tariffs for coal, metal by rail and natural gas) to influence the relative security of industrial enterprises using different fuels. and resources. However, the "uniqueness" of state influence on the security of energy interests of industrial enterprises is that the cost of production due to the rising cost of the above components of the cost of production increases in clearly unfavorable market conditions, which, consequently, leads to the multiplicative deterioration [14].

At the same time, Ukraine has developed a National Energy Efficiency Program, which pays considerable attention to ensuring the development of national standards for determining the energy intensity of technological processes of production of relevant products, works and services. The implementation of these national standards should result in the establishment of industry-specific energy intensity limits of technological units of production based on calculations of technical characteristics of energy-efficient equipment, and, consequently, reduce the energy intensity of Ukraine's gross domestic product, which is now 2.6 times higher than average the level of energy intensity of gross domestic product of the world [15].

3.2 Methodology for Assessing the Security of Energy Interests of Enterprises

In our opinion, the security of energy interests of enterprises should consist of security of energy efficiency and security of energy supply (fig. 1).

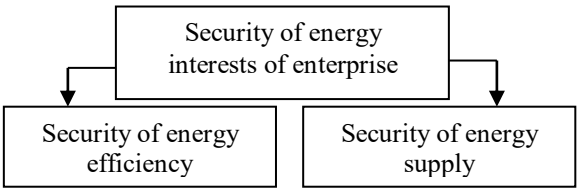

Fig. 1: Components of security of energy interests of enterprise (*proposed by Mishchuk I.*)

Shown in Fig. 1 security components are characterized by relevant indicators. It is most expedient to assess energy efficiency security based on the coefficient of energy intensity of products, and security of energy supply - the coefficient of conformity of actual volumes of energy supplies in monetary terms to the volumes declared in the concluded agreements.

The state of security of energy interests in the current period characterizes the time by which the company lags behind its competitor in the country. The state of security in the medium term characterizes the time it takes for an enterprise to

catch up with best foreign practices. Therefore, the limiting value for the energy efficiency security indicator can have different values:

- the best (lowest) value among competing companies in the country;
- values according to target programs, projects, etc. For example, as part of its international obligations, Ukraine needs to introduce greenhouse gas emission allowance trading and reduce CO2 emissions by 65% by 2030 from 1990 levels. This value can also be used as a liminal value;
- the best (lowest) value among the companies - world leaders in a particular industry (for example, from the TOP-40 leading mining companies in the world) or in general, the best-known value that the industrial enterprise has managed to achieve.

For the indicator of energy supply security, the best value is obvious and it is equal to 1 - a value that corresponds to the equality of actual supply to supplies specified in the concluded contracts (including compliance with current and strategic plans of the enterprise) [16].

At the same time, the values of indicators can change at different speeds, which need to be taken into account. To this end, it is advisable to determine the average time-weighted by the rate of change of the relevant security indicators. Therefore, we propose to estimate the time required to achieve the limiting time for the security of energy interests (*Tei*) according to the formula [17]:

$$\mathrm{Tei} = \frac{v(\mathrm{Ke})\times\Delta\mathrm{T}(\mathrm{Ke})+v(\mathrm{Kc})\times\Delta\mathrm{T}(\mathrm{Kc})}{v(\mathrm{Ke})+v(\mathrm{Kc})}, \quad (1)$$

where *v(Ke), v(Kc)* – the speed at which the values of energy intensity coefficients and compliance of deliveries with the concluded contracts change;

$\Delta T(Ke)$, $\Delta T(Kc)$ – periods required to achieve values according to the coefficient of energy intensity and the coefficient of conformity of supplies to the concluded contracts of their limiting values, quarters.

The period found must be compared with a certain period that characterizes the economic cycle. In today's conditions, we consider the most appropriate for this business cycle Kitchin, the average duration of which is, as is well known, 12 quarters. To assess the state of security of energy interests (*Si*) you need to use the formula [17]:

$$S\mathrm{i} = 1 - \frac{\mathrm{Tei}}{\mathrm{Tc}}, \quad (2)$$

where *Tc* – duration of the economic cycle, quarters.

The scale of interpretation of possible states of security of energy interests is presented in the table 2.

Table 2. Scale of interpretation of possible security states of energy interests

Range of quantitative values of security state	Qualitative interpretation
$Si=0$	the catastrophic state of security
$0<Si<0.25$	minimum state of security
$0.25\leq Si<0.5$	the low state of security
$0.5\leq Si<0.75$	medium state of security
$0.75\leq Si<1.0$	the high state of security
$Si=1.0$	the very high state of security

Source: compiled by Mishchuk I. based on the application of Delphi method, in which experts were employees of security services of mining and processing plants of Kryvbas (Ukraine)

Thus, the stages of assessing the security of energy interests of the enterprise are enlarged as follows:

1. Construction of trend equation using actual data separately for each indicator of corresponding security subspecies. In this case, the quarterly data of the actual values of the coefficients of energy intensity of products and compliance of the actual supply of energy resources to the concluded contracts of mining enterprises from 01.01.2015 to 31.12.2019 were used.
2. Definition of the trend equation; selection of the value of the rate of change of the indicator. In this case, the equations of the trend are built separately for each indicator of each enterprise - the object of study, and separately - the industry average trend of each indicator as a whole for enterprises in the mining subsector.
3. Estimation of periods of achievement of corresponding liminal values by indicators with the use of constructed trends [17].

3.3 Evaluation of the Security of Energy Interests of Ukrainian Enterprises of the Gas-Fired and Metallurgical Complex

In table 3 the liminal value of the indicator of energy efficiency security - the coefficient of energy efficiency of products, as well as the indicators of the state of energy efficiency security at mining enterprises.

Table 3. The results of the assessment of the state of security of energy efficiency of mining and metallurgical enterprises complex

Indicator	2018	2019
Liminal quarterly value of energy efficiency security indicator (coefficient of product energy intensity)	0,093	0,078
PrJSC Northern GZK		
Regression equation coefficient (a)	0,2194	0,2088
Speed coefficient (b)	-0,0066	-0,005
Quarter in which liminal value is reached	3 quarter 2019	2 quarter 2021
Period of reaching a liminal value of *Tei*, quarts	3	6
Period of achievement of the liminal value of *Tei* taking into account cycle, quarts	3	6
Security state indicator	0,74	0,49
PrJSC Central GZK		
Regression equation coefficient (a)	0,2667	0,2524
Speed coefficient (b)	-0,0091	-0,0072
Quarter in which liminal value is reached	3 quarter 2019	4 quarter 2020
Period of reaching a liminal value of *Tei*, quarts	3	4
Period of achievement of the liminal value of *Tei* taking into account cycle, quarts	3	4
Security state indicator	0,74	0,65
PrJSC InGZK		
Regression equation coefficient (a)	0,2674	0,2552
Speed coefficient (b)	-0,0075	-0,0054
Quarter in which liminal value is reached	3 quarter 2020	over 12 quarters*
Period of reaching a liminal value of *Tei*, quarts	7	13
Period of achievement of the liminal value of *Tei* taking into account cycle, quarts	7	12
Security state indicator	0,40	0
JSC Southern GZK		
Regression equation coefficient (a)	0,1237	0,1185
Speed coefficient (b)	-0,0036	-0,0027
Quarter in which liminal value is reached	4 quarter 2018	4 quarter 2019
Period of reaching a liminal value of *Tei*, quarts	0	0
Period of achievement of the liminal value of *Tei* taking into account cycle, quarts	0	0
Security state indicator	1,00	1,00

**more than three years (exceeding the Kitchin cycle)*

Source: calculated by Mishchuk I., information is processed on basis of data of financial statements and management accounting of PrJSC Northern GZK, PrJSC Central GZK, PrJSC InGZK, JSC Southern GZK

It should be noted that the positive for the company is the reduction of the coefficient of product energy intensity, so the liminal value for this indicator is set as the minimum value of this indicator among all surveyed companies.

As can be seen from table 3, on 31.12.2018 and 31.12.2019 according to JSC Southern GZK, the energy efficiency security indicator is equal to 1, because this enterprise has already achieved a limiting value. Thus, JSC Southern GZK has an excellent state of energy efficiency security.

Energy efficiency security indicators have decreased at PrJSC Northern GZK. If on 31.12.2018 security indicator was equal to 0.74 and there was a good state of security, then on 31.12.2019 the value of the indicator decreased to 0.49, which indicates a satisfactory state of security. A similar negative trend is observed at all mining enterprises in the sample. Yes, at PrJSC InGZK on 31.12.2018 there was a satisfactory state of security, then on 31.12.2019 already an unsatisfactory condition. As an indicator of energy security, we have established a coefficient of compliance of the actual volumes of energy supplies with the volumes declared in the concluded agreements. The supply of these resources at the mining enterprises in the period under study was carried out by the plans because energy resources are critical for the production of their products.

Thus, the factual and liminal value of this indicator in all surveyed enterprises is equal to one, and the period of its achievement is zero. The security indicator of energy supply for all mining companies in 2018-2019 is 1. To assess the integrated state of security of energy interests, the equation of the trend on the liminal values of the indicator of energy efficiency security - the coefficient of energy intensity of products (fig. 2).

It should be noted that in all enterprises included in the sample, there is a single downward trend in this indicator from 2015-to 2019.

The results of the assessment of the integrated indicator of the state of security of energy interests are given in table 4. In determining this indicator, the value of the rate of change of the energy efficiency security indicator according to the regression equation obtained above (-0.0027) was taken into account, but taken as a module as a weighting factor. As for the security indicator of

energy supply, its value did not change in the study period. Therefore, the rate of its change is zero (Table 4).

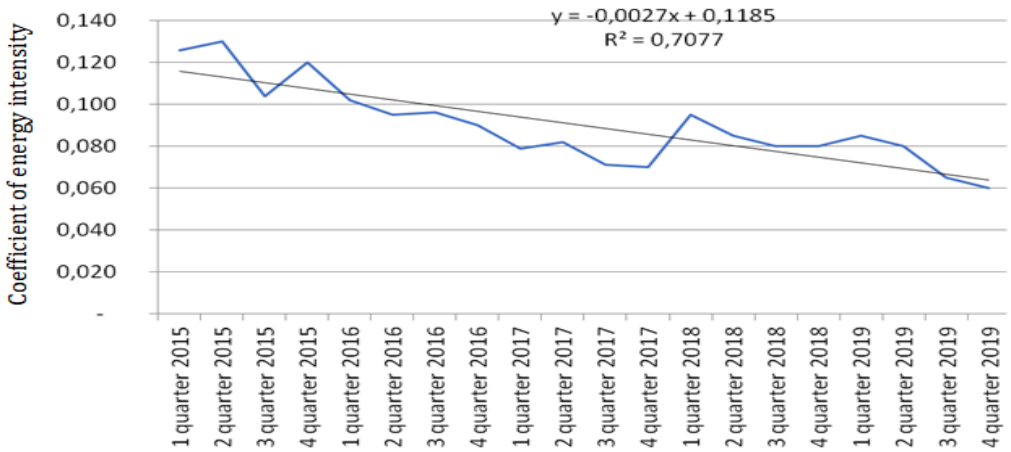

Fig. 2: The normative trend for the indicator of the security of energy efficiency - the coefficient of energy intensity of products *(Source: calculated by Mishchuk I. according to the data of enterprises - objects of sampling)*

As can be seen from Table 4, the integrated indicators of security of energy interests coincide with the indicators of security of energy efficiency in all surveyed enterprises. This is because the rate of change of the security indicator of energy supply is zero. This speed is a factor of weight in the calculation of the integrated indicator of the security of energy interests.

Table 4. Integrated indicators of the state of security of energy interests in mining enterprises in 2018-2019

Indicator	2018	2019
PrJSC Northern GZK		
Period of reaching the liminal value for:		
energy efficiency security indicator, quarters	3	6
energy security indicator, quarters	0	0
The numerator of integrated indicator of energy interests security	3	6
Integral indicator of energy interests security state *(Si)*	0,74	0,49
PrJSC Central GZK		
Period of reaching the liminal value for:		
energy efficiency security indicator, quarters	3	4
energy security indicator, quarters	0	0
The numerator of integrated indicator of energy interests security	3	4
Integral indicator of energy interests security state *(Si)*	0,74	0,65
PrJSC InGZK		
Period of reaching the liminal value for:		
energy efficiency security indicator, quarters	7	12
energy security indicator, quarters	0	0
The numerator of integrated indicator of energy interests security	7	12
Integral indicator of energy interests security state *(Si)*	0,40	0,00
JSC Southern GZK		
Period of reaching the liminal value for:		
energy efficiency security indicator, quarters	0	0
energy security indicator, quarters	0	0
The numerator of integrated indicator of energy interests security	0,0	0
Integral indicator of energy interests security state *(Si)*	1,00	1,00

Source: calculated by Mishchuk I.

Consequently, the impact of energy supply on the integrated security indicator is absent.

3.4 The Role of Exchange Trade in the Energy Market in the Formation of Security of Energy Interests of Enterprises

The Ukrainian Energy Exchange was established in 2010 view. This, in turn, encourages companies to participate more actively in bidding. Thus, in 2020 the volume of energy sales reached UAH 105 billion, which is almost twice as much as in 2019. In addition, in the electricity market from 2021, it is impossible to sell electricity in too large lots. There is a limit of 50 MW or 20% of the total volume for 1 lot. As a result, the price gap between the auction

results has narrowed. More potential buyers are coming to the auction, who previously could not afford to buy electricity directly. This promotes fair competition between market participants and has a positive effect on the security of energy interests of enterprises [18].

The Energy Exchange has two Councils of sections in the areas of "Electricity" and "Natural Gas". These are advisory bodies that provide feedback to exchange participants, as well as develop a common position for dialogue with the authorities, and regulators. Councils develop proposals and prepare various analytical documents and recommendations for the operation of the exchange and the market as a whole [18]. From the organizational point of view, the above also contributes to strengthening the security of the energy interests of enterprises.

Ukraine has created legislation by EU standards, which regulates the activities of commodity exchanges. In particular, important amendments to the law on simplification of investment attraction and the introduction of new financial instruments were adopted. Due to this, the Law "On Capital Markets and Organized Commodity Markets" and the Law "On Commodity Exchanges" came into force. These laws provide a unified approach to the organization of asset trading to ensure transparency in pricing and to prevent manipulation, which has a positive impact on the security of energy interests of enterprises. The market regulator is the National Securities and Stock Market Commission. In addition, other public authorities are involved in the regulation of organized commodity markets and commodity exchanges: the Antimonopoly Committee, the Ministry of Energy, etc. [18].

Currently, the energy exchange is a highly developed IT structure. And to remain on the market in modern conditions, we need specialists who would have the necessary digital and other competencies both to work on the energy exchange and to work at enterprises - participants in the energy market.

3.5 Innovative Competencies of Personnel as a Factor in Ensuring the Security of Energy Interests of Enterprises

From the point of view of energy efficiency, decommissioning / replacement of obsolete equipment is an important stage in the development of the Ukrainian industry in the medium term. The practical dimension of these processes, expressed in the implementation of plans and the volume of production of specific products, will depend on market conditions and the international competitive environment. For example, limiting the production of open-hearth steel and the introduction of continuous casting systems today should be the main ways to improve energy efficiency at the stage of production and further processing of steel [15].

The practically achievable level of reduction of total energy consumption at the enterprises of the mining and metallurgical complex is 1522.6 thousand twh by 2020 (Table 5).

Table 5. Promising energy efficiency measures for enterprises of the mining and metallurgical complex

Name of the program /event	The actual amount of energy savings, 2020
1. Technical re-equipment of energy economy of enterprises based on new generation equipment	274,07
2. Development of new technologies for smelting and rolling of titanium sheets and products	272,55
3. Reconstruction and modernization of concentrators, pelletizers, and sinter plants	260,36
4. Technical re-equipment and commissioning of new smelting facilities for titanium-magnesium production	245,14
5. Equipping technological units with heat recovery units and evaporative cooling systems	242,09
6. Modernization and reconstruction of units for the production of hot-formed welded and cold-formed pipes	228,39

Source: [15]

The implementation of these measures requires from the staff of industrial enterprises (especially that part of it that is engaged in energy supply) the appropriate modern competencies. In addition, it should be borne in mind that the mining and metallurgical complex is actively working to automate business processes and production, as well as its greening. Therefore, to maintain stability in the face of challenges and threats in the energy market, it is necessary to move to a new energy business model of doing business. This causes a gap in the existing and necessary skills and competence of staff.

Thus, companies are faced with the need not only to train staff in new digital skills, which was emphasized in [19; 20], but also the need to attract staff with new professions (such as, for example, shown in [10; 21]).

The new competencies of the personnel of the energy sector, as well as the employees involved in the energy supply of the enterprises of the mining

and metallurgical complex, should include the following:

- digital and technological skills (for the implementation of innovative technological projects, working with equipment in remote wells and quarries, programming and coding, developing the Internet of Things, cybersecurity, etc.);
- analytical skills (for working with big data);
- management skills (to manage infrastructure and automated processes, control sensors, and equipment on remote wells, quarries, etc., as well as manage teams of people working remotely);
- flexibility and adaptability (for lifelong learning to improve acquired skills and retraining if necessary) [10; 20].

It should be emphasized that all skills are closely related.

The new, most popular professions of the energy sector staff, as well as employees involved in the energy supply of mining and metallurgical enterprises shortly, will be the following:

- big data analysts and architects;
- specialists in cybersecurity, digital logistics, and digital marketing;
- specialists in artificial intelligence and the Internet of Things;
- engineers for automation of production and business processes;
- drone and robotics operators;
- HP managers working with staff working remotely [10; 21].

Therefore, to ensure the security of energy interests, enterprises must create conditions for training, retraining of existing staff and, if necessary, attracting new ones. However, the current situation in Ukraine is that higher education institutions are not able to provide the full list of necessary modern professions. Therefore, the enterprises of the mining and metallurgical complex have two directions in this matter: to finance the training of their staff abroad or the creation of universities where they will teach new specialties. In any case, this requires significant financial costs and special investment programs in personnel management systems.

4 Conclusion

Thus, the proposed methodology for assessing the security of energy interests of the enterprise is based on determining the periods of achievement of indicators of their liminal values, taking into account the speed of their change.

Such changes must be determined by trends in the enterprise.

In particular, according to the results of calculations, it is established that the energy security indicator for all mining enterprises of Ukraine in 2018-2019. was 1, which corresponds to a very high state of this security.

A similar state of energy efficiency security in this period took place only at JSC Southern GZK, as the indicator of this security is also equal to 1. At all other surveyed enterprises, energy efficiency security indicators deteriorated. The worst state of this security was in 2019 at the PrJSC InGZK.

Based on the results obtained by the proposed method, it is possible to draw conclusions about the need for managerial intervention, decision-making, and taking appropriate measures to improve the security of energy interests in general and its components in particular.

In particular, it was found that such measures are needed by such Ukrainian enterprises of the mining and metallurgical complex as PrJSC InGZK, as well as PrJSC Northern GZK.

The transition from personal contracting at the enterprise level to stock trading contributes to market liberalization. This will ensure competition, more transparent and fairer pricing, and create the conditions for improving the security of energy interests of enterprises. Industrial enterprises need to be more active in bidding on the energy exchange. This will not only have a positive impact on the security of their energy interests but will also provide the following benefits at the country level:

1) will promote the formation of national price benchmarks for energy in a transparent competitive way, because the more companies sell and buy energy resources on the national exchange - the more accurate and fair the prices will be;

2) increase the country's investment attractiveness if the market operates according to rules and standards clear to Europe;

3) the possibility of control without the need for manual government regulation.

One of the main conditions for ensuring the security of energy interests of the Ukrainian mining and metallurgical complex is the reorientation of the production apparatus and the introduction of resource-saving technologies that will dramatically reduce energy and fuel consumption, as well as attracting and training employees in new competencies and professions.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

-Mishchuk Ievgeniia developed ideas, including developing a methodology for assessing the security of energy interests of enterprises and conducted calculations (paragraphs 3.2-3.3 written alone);
-Bondarchuk Olga systematized the problems of the energy market of Ukraine;
-Riabykina Nataliia, Riabykina Yekateryna revealed the issues of exchange trade in the energy market;
-Rozhenko Oleksandra reviewed the literature;
-Matkovskyi Petro, Tkachenko Sergii analyzed the energy sector of Ukraine;
-Kornukh Oksana revealed the issue of modern competencies of personnel employed in the energy supply of the enterprise.