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Okhrimenko Oksana
Doctor in Economics, Professor
ORCID ID: 0000-0001-7361-3340
Manaienko Iryna
Candidate of Economic Sciences, Associate Professor
ORCID ID: 0000-0002-3246-3603
National Technical University of Ukraine
"Igor Sikorsky Kyiv Polytechnic Institute"

Охріменко О. О., Манаєнко І. М.
Національний технічний університет України
«Київський політехнічний інститут імені Ігоря Сікорського»

RISK MANAGEMENT INSTRUMENTS OF EU ENERGY SECURITY: THROUGH INTEGRATION INTO EFFICIENCY

ІНСТРУМЕНТИ УПРАВЛІННЯ РИЗИКАМИ ЕНЕРГЕТИЧНОЇ БЕЗПЕКИ ЄС: ЧЕРЕЗ ІНТЕГРАЦІЮ ДО ЕФЕКТИВНОСТІ

Economic security forms the basis for the sustainable development of national economies. The European Union consolidates the economic interests of the Member States and has developed many programmatic documents aimed at preventing and minimizing threats to economic security. Activities in this area are subject to a single strategy that defines institutions, guidelines and risk management systems. The aim of the article is to assess the impact of the EU economic security risk management system on the implementation of certain provisions of the Europe 2020 strategy and "A new strategic agenda 2019–2024", taking into account performance targets and on the basis of the principles of solidarity in the energy sector. EU integration processes are aimed at refining current priorities and setting strategic goals for energy security, as the dominant component of economic security, by minimizing current and preventing future risks, respectively. As energy efficiency determines the level of implementation of EU strategic initiatives, the study of its economic security risk management focused on indicators that affect the energy intensity and energy productivity of the economy. As a result, factor analysis and econometric modelling allowed us to interpret the conclusion that the total energy intensity of the EU countries varies depending on the change in primary energy production by 90%, the value of closed gas reserves by 73%, the share of energy produced using renewable energy sources by 95%. Accordingly, the objectives of the Europe 2020 strategy correspond to measures involving appropriate tools and forms of financing, consultation, and project implementation and are aimed at making progress on risk reduction through the consolidation of efforts and serve as a basis for the implementation of the Strategic Agenda for 2019–2024. Scientific provisions for the institutionalization of relations within supranational entities are a fundamental basis for managing energy security risks using the principles of competition, cooperation and solidarity. As a tool to counter the risks of economic security, energy solidarity is manifested through a set of goals that serve as a roadmap for balancing the interests of the region through the implementation of joint projects aimed at improving economic security.

Keywords: *competition, directives, energy, institutions, partnership, project, solidarity, strategy.*

Економічна безпека є основою сталого розвитку національних економік. Європейський Союз консолідучи економічні інтереси держав-членів, розробив ряд програмних документів, спрямованих на запобігання та мінімізацію загроз економічній безпеці. Діяльність у цій сфері підпорядковується єдиній стратегії, яка визначає інститути, рекомендації та системи управління ризиками. Метою статті є оцінювання впливу системи управління ризиками економічної безпеки ЄС на реалізацію окремих положень стратегії Європа 2020 та Стратегічному порядку денному на 2019–2024 роки з урахуванням цільових показників ефективності та на основі принципів солідарності у сфері енергетики. Інтеграційні процеси в ЄС спрямовані на уточнення поточних пріоритетів та встановлення стратегічних цілей енергетичної безпеки, як домінуючого компонента економічної безпеки, шляхом мінімізації поточних та запобігання майбутнім ризикам відповідно. Оскільки енергоефективність визначає рівень реалізації стратегічних ініціатив ЄС, дослідження управління ризиками його економічної безпеки зосередилося на показниках, що впливають на енергоємність та енергопродуктивність економіки. Проведений факторний аналіз та економетричне моделювання дозволили сформулювати висновок про те, що сумарна енергоємність країн ЄС змінюється в залежності від зміни виробництва первинної енергії на 90%, величини закритих запасів газу на 73%, частка енергії, виробленої з використанням відновлюваних джерел енергії на 95%. Відповідно, цілі стратегії «Європа 2020» відповідають заходам із залученням відповідних інструментів і форм фінансування, консультацій та реалізації проектів, спрямовані на досягнення прогресу у зменшенні ризиків шляхом

консолідації зусиль і виступають підгрунтям для реалізації Стратегічного порядку денного на 2019–2024 рр. Наукові положення інституціоналізації відносин усередині наднаціональних утворень складають фундаментальну основу для управління ризиками енергетичної безпеки з використанням принципів конкуренції, співробітництва та солідарності. Як інструмент протидії ризикам економічної безпеки, енергетична солідарність проявляється через комплекс цілей, які служать дорожньою картою для збалансування інтересів регіону шляхом реалізації спільних проектів, спрямованих на підвищення економічної безпеки.

Ключові слова: *конкуренція, директиви, енергетика, інститути, партнерство, проект, солідарність, стратегія.*

Introduction. Activation of integration processes between countries is associated with numerous risks threatening economic security. Economic security, as a multifaceted phenomenon, covers various spheres of economic activity. In terms of political conflicts and natural disasters priority attention is given to the energy sector, which is the source of supply of resources involved in production processes and creating GDP. The European Union as an economic entity with the relevant institutions in the process of implementing the objectives aimed at securing strategic positions actively uses the regional approach, good neighborly relations with partner countries, various forms of partnership and cooperation, energy solidarity, which serves as a consolidation of efforts and achievement energy efficiency parameters. However, the implemented measures do not fully stabilize the situation in the energy sector and therefore do not contribute to the achievement of the set parameters of individual key indicators. A number of measures applied are declarative, require considerable funding, but do not have a significant impact and economic security in the region. There are a number of studies on different levels of security in the country. The concept of national security in general implies resilience against any threat to sovereignty, autonomy, internal stability or the territory of a nation-state, encompassing both internal and external threats Retter L., Frinking E.J., Hoorens S., Lynch A., Nederveen F., Phillips W.D. [1]. Energy security is an important policy goal for most countries and can use a wide range of tools, the mechanism of which is reflected in studies Demski C., Poortinga W., Whitmarsh L. [2], Andersen S. S., Goldthau A., Sitter N. [3], Elbassoussy A. [4], Bihun U. [5]. The goal of energy security policy should be to understand, reduce and mitigate risks, not to try the impossible to avoid risk altogether. Various aspects of energy security risk management in the works of Kleindorfer P.R. [6], Ioannoua A., Angusb A., Brennan F. [7]. At the same time, the existing divisions do not sufficiently disclose the mechanisms for managing the energy security risks of economic entities on the basis of an institutional approach, which provides for compliance with the principles of solidarity, competition and cooperation.

The purpose of the study. The aim of the article is to assess the impact of the EU energy security risk management system on the implementation of certain provisions of the Europe 2020 strategy and "A new strategic agenda 2019–2024", taking into account performance targets. Achieving this goal is preceded by the following tasks:

1) identify and group the factors that affect the energy and economic security of EU member states;

2) on the basis of correlation-regression analysis to develop econometric models that reflect the relationship between potential risks and the main parameters of energy security;

3) substantiate the mechanisms of risk management of economic security of the EU.

Methodology. The methodological part of the investigation is based on the research of parameters that have a significant impact on all sectors of the EU economy and economic security in general, which have been reflected in official documents (directives) to identify key parameters that shape the EU's energy security and identify their impact on energy efficiency as a key parameter of the strategy «Europe 2020». Thus, according to official Eurostat definitions:

– Energy intensity is the ratio between gross inland energy consumption (GIEC) and gross domestic product (GDP), calculated for a calendar year. GIEC is calculated as the sum of the gross inland consumption of the five sources of energy: solid fuels, oil, gas, nuclear and renewable sources.

– Energy productivity – the indicator results from the division of the gross domestic product (GDP) by the gross available energy for a given calendar year; it measures the productivity of energy consumption and provides a picture of the degree of decoupling of energy use from growth in GDP.

– Energy efficiency – this dataset covers indicators for monitoring progress toward energy efficiency targets of the Europe 2020 strategy implemented by Directive 2012/27/EU on energy efficiency [8]. Targets for 2030 are included based on Directive (EU) 2018/2002 [9]. The European Union (EU) has committed itself to a 20% reduction of energy consumption by the year 2020 compared to baseline projections. A statistical unit in energy statistics can be for example enterprises, local units, establishments or households. it is calculated as the overall efficiency of the listed facilities, that is, the ratio of the total energy produced by the system and the energy it consumes in the production process.

If energy and productivity indicators are used to measure the energy needs of the national and joint European economy, then the energy efficiency indicator is an indicator of the degree of implementation of EU strategic initiatives.

Therefore, in order to determine the most influential factors for the EU's energy efficiency in line with the strategy "Europe 2020", the indicators of energy intensity and energy performance will be further used as effective parameters of the correlation analysis based on initial data. All other indicators should be considered influential factors. They are grouped into 3 groups that make up the social, environmental, and resource components of energy security.

Based on the correlation-regression analysis of the dependence of the total energy intensity of the EU countries on the most significant, it is planned to obtain econometric models that reflect the nature of their interconnections, and thus allow to identify of potential risks that affect energy security.

The identified risks and existing approaches of the EU to solidarity policy will allow substantiating the mechanisms of economic security risk management to intensify the process of implementation of the strategy "Europe 2020" in the field of energy efficiency and to develop appropriate theoretical and methodological provisions.

Table 1

The main energy indicators of the European Statistics Department

Indicators	Effective parameters for analysis		Macroeconomic component			Environmental component		Resource component			
	Y1 – Energy intensity	Y2 – Energy productivity	x1 – Gross available energy	x2 – Energy efficiency	x3 – Gross energy consumption per capita	x4 – Sulfur oxide emissions by source sector energy production and distribution	x5 – Emissions CO^2	x6 – Primary energy production	x7 – Closing stock for natural gas	x8 – Closing stock for oil products	x9 – Share of energy from renew. sources
	kg of oil equiv. (KGOE) per 1000 euro	*Euro per kg of oil equivalent*	*mln tonnes of oil equiv.*	*mln tonnes of oil equivalent*	*tonnes of oil equiv.*	*1000 tonnes*	*tonnes per capita*	*mln tonnes of oil equivalent*	*bln cubic metres*	*1000 tonnes*	*%*
2011	134,7	7,4	1761	1604	3403	2517	9,5	810,2	66543,0	168952	13,4
2012	133,9	7,5	1743	1593	3366	2216	9,3	802,7	65515,1	167053	14,7
2013	131,9	7,6	1722	1577	3322	1853	9,1	796,8	80073,3	168646	15,4
2014	124,8	8,0	1659	1512	3186	1661	8,7	778,8	87798,0	168136	16,2
2015	123,7	8,1	1683	1538	3226	1543	8,8	774,3	83784,2	180191	16,7
2016	122,0	8,2	1693	1545	3231	1124	8,7	759,7	76188,4	178665	17,0
2017	120,9	8,3	1721	1562	3279	1074	8,8	758,5	77169,9	170711	17,5
2018	117,7	8,5	1709	1552	3246	1024	8,6	755,1	83712,9	166263	18,0
2019	112,7	8,4	1501	1549	3241	998	8,5	754,9	81782,7	160358	17,5
2020	110,1	8,6	1379	1529	3230	996	8,4	753,3	80974,6	158944	17,1

Source: compiled by the authors according to Eurostat

Results. Factor analysis of EU energy security. In order to evaluate the effectiveness of energy efficiency measures under the EU 2020 strategy and in accordance with Directive 2012/27/EC and Directive 2018/2002/EC, the factors affecting energy and economic security have been identified and grouped. The grouping of these indicators into the main components of the economic security environment (Table 1) makes it possible to identify within the groups the most important ones, continue their detailed study and specify measures for influencing the possible risks.

Thus, according to table 2, the most significant factors affecting the EU's energy efficiency are concentrated in the groups of macroeconomic and environmental components, namely the variation of the energy intensity indicator:

– from 60% to 79% due to the change in the social component of the predictors;

– from 74% to 85% is explained by the change in the values of the environmental component of the predictors. All the most significantly influential factors of the resource component (Table 2) in terms of the correlation coefficient have a closer relationship with energy intensity, a higher percentage of influence on the coefficient of determination, compared with other components of the influential factors, except the predictor for "Closing stock for oil products", which has correlation indices with values that go to zero. Interpretation of specific coefficients of determination of the resource component makes it possible to formulate the conclusion *that the total amount of energy intensity of EU countries varies depending on the change of the amount of production of primary energy resources by 90%, the magnitude of closed gas reserves by 73%, from the share of energy produced using renewable energy sources by 95%* (Table 2).

Therefore, to further study the patterns of change in EU energy efficiency, depending on the most significant factors of influence in this work, it is advisable to use the indicator of energy intensity as a resultant parameter of multivariate correlation-regression analysis, and as predictors indicators grouped by the main components of EU energy security indicators in table 2.

The results of the correlation-regression analysis of the dependence of the total energy intensity of EU countries (Y1) on the most significant social, environmental, resource factors (Table 3) made it possible to obtain econometric models that reflect the nature of their relationships, and the Fisher coefficients and multiple correlations confirmed the closeness exposure.

Calculations of values of mean error of approximation by the formula:

$$\overline{\xi} = \frac{1}{n} \cdot \sum \frac{\left| y_i - \overline{y_x} \right|}{y_i} \cdot 100$$

for all the obtained econometric equations (Table 1) allowed to estimate the difference between the approximated and real values of the investigated value, namely, the obtained values of the quantifier of losses do not exceed 6% for all models proving the high quality of regression and the possibility of further use of models.

The analysis of the reliability of the first econometric equation relations (Table 3) by Student's coefficients – t (all t-statistics values greater than t-critical values) confirmed the fact that the dependence of the energy intensity of EU

Table 2

Results of the correlation analysis of the dependence of the main indicators of the EU 2020 Energy Strategy on the factors affecting EU energy security

List of variables – predictors, units	Predictor designation	Correlation indices for performance variables			
		Energy intensity (Y1), *kg of oil equivalent per thousand euro*		Energy productivity (Y2), *euro per kg of oil equivalent*	
		$r_{ее}$	$R_{ее}^2$	$r_{еп}$	$R_{еп}^2$
Macroeconomic component					
Gross available energy, *thousand tonnes of oil equivalent*	X1	0,79	0,63	-0,79	0,64
Energy efficiency, *million tonnes of oil equivalen*	X2	0,77	0,60	-0,79	0,63
Gross energy consumption per capita, *tonnes of oil equivalent*	X3	0,89	0,79	-0,89	0,79
Environmental component					
Sulfur oxide emissions by source sector energy production and distribution, *tonnes*	X4	-0,86	0,74	0,87	0,76
Emissions CO_2, *tonnes per capita*	X5	0,92	0,85	-0,93	0,87
Resource component					
Primary energy production, *thousand tonnes of oil equivalent*	X6	0,95	0,9	-0,96	0,92
Closing stock for natural gas, *million cubic metres*	X7	-0,85	0,73	0,84	0,69
Closing stock for oil products, *tonnes*	X8	0,16	0,02	-0,17	0,03
Share of energy from renewable sources, %	X9	-0,98	0,95	0,98	0,96

Table 3

Results of correlation-regression analysis of dependence of energy intensity of EU countries (Y1) on social, environmental, resource factors

Econometric models	R^2	F-statistic (significance)	t- statistic	Pi- value	Average approximation error, ξ, %
$Y_1(x_1, x_2, x_3)=0,0338*x_3+0,727*x_2-$ $-0,0006*x_1-48,437$	0,92	27,066 (3,2E-04), *Fкр=4,35*	*t1*= -3,29, *t2*= 3,36, *t3*= 2,64, *при tкр=2,36*	P_1=0,0133, P_2=0,0121, P_3= 0,0332	5,787674
$Y_2(x_4,x_5)=90,64+9,067E-06x_4+2,358x_5$	0,89	32,545 (1,4E-04), *Fкр=4,46*	*t4*= 2,06, *t5*= 0,41, *при tкр=2,3*	P_4=0,0729, P_5=0,693	5,786694
$Y_3(x_6, x_7, x_9)=128,195+0,0000618x_6-$ $-0,000000128x_7-2,504x_9$	0,96	63,52 (1,922E-05), *Fкр=4,35*	*t6*= 1,104, *t7*= -1,21, *t9*= -2,27, *при tкр=2,36*	P_6=0,3059, P_7=0,2662, P_9= 0,0574	5,7872594
$Y_4(x_{12})=27,19+1,936x_{12}$	0,87	61 (2,68E-05), *Fкр=4,26*	*t12*= 7,8, *при tкр=2,26*	P_{12}= 2,67996E-05	5,786358

countries (Y1) on the social component of influential factors (gross available energy, energy efficiency (primary energy consumption), gross per capita energy consumption) is valid for the entire population as well, not just for the aggregate sample of the surveyed data. The p-statistic value is <0.05, ie the sample has only 5% – the significance of zero probability that the correct hypothesis about the insignificance of the regression coefficients at parameters x1, x2, x3 will be rejected, or it can be argued that model Y1 is adequate to the statistical sample of the initial data.

Analysis of the reliability of the links between the energy intensity of the EU countries and the two environmental factors (specific emissions of sulfate oxide in the production and distribution of energy, specific emissions of CO_2), as well as three resource factors (primary energy production, closed energy from gas, the share of energy from gas, of energy sources in the total energy consumption) econometric models according to Y2, Y3 (Table 3) by t-statistic values and probability level values leads to the conclusions about the unreliability of their relationships. This means that the established bond strength in equations Y2 and Y3 is valid only for the sample of the data being investigated. This is especially true of predictors x4 – specific emissions of sulphur oxide in the production sector, x6 – production of primary energy resources, x7 – the share of energy produced using renewable energy sources in the total energy consumption, their regression coefficients in their magnitude and zero values p-statistic values prove that the probability that the correct hypothesis for the insignificance of these regression coefficients is neglected is 7.30 and 27 %, respectively.

According to the results of correlation-regression analysis, it can be stated that under the assumption that the influence of all other predictors is equal to zero then:

– by increasing the amount of gross available energy by 1 thousand tonnes of oil equivalent, the energy intensity of EU countries will decrease by 0.0006 kg of conventional fuel per 1000 euros;

– with an increase in the energy efficiency of 1 million tonnes in oil equivalent, the energy intensity of EU countries will increase by 0.727 kg of conventional fuel per 1000 euros; According to the methodology for calculating

Eurostat indicators, energy efficiency should be understood as the final consumption of primary energy. EU pledges to reduce energy consumption by 20% by 2020;

– if the gross energy consumption per capita is increased by 1 ton in oil equivalent, the energy intensity of EU countries will increase by 0.0338 kg of conventional fuel per 1000 euros;

– by increasing the amount of specific sulphate oxide emissions in the production and distribution of energy by 1 tonne, the energy intensity of EU countries will increase by 9,067E-06 kg conventional fuel per 1000 euros, i.e. almost zero kg;

– by increasing the amount of CO_2 emissions per tonne per capita, the energy intensity of EU countries will increase by 2,356 kg of conventional fuel per 1,000 euros;

– if the production of primary energy resources is increased by 1 thousand tons in oil equivalent, the energy intensity of the EU countries will increase by 0.0618 grams of conventional fuel per 1000 euros;

– if the number of closed gas reserves is increased by 1 thousand m^3, the energy intensity of the EU countries will decrease by 0.000000128 kg. conventional fuel per 1,000 euros, ie practically zero kg;

– if the share of energy produced using renewable energy sources in the total energy consumption is increased by 1%, the energy intensity of EU countries will be reduced by 2.5 kg of conventional fuel per 1000 euros.

Thus, the development of renewable energy, the level of primary energy consumption, and emissions (CO_2, sulphur oxide, etc.) influence the EU's energy security parameters. Sensitive to the EU's strategic goals, the EU is focusing its efforts on overcoming challenges and minimizing risks through a policy of solidarity. goals, the EU is focusing its efforts on overcoming challenges and minimizing risks through a policy of solidarity.

Energy availability issues. The EU has to import it to meet its energy needs. According to Eurostat, in the period 2011-2020 the lion's share of the supply of solid fossil fuels, crude oil and gas came from the Russian Federation. It is followed by Norway (crude oil and gas supply) and USA (an increase in the supply of solid fossil fuels and a replacement for Colombia) (Table 4).

Each EU country addresses the issue of securing the economy with energy, based on its resources and needs. Thus, in Cyprus, Malta, Greece, Sweden and Romania, oil imports account for more than 80% of energy imports. In Hungary, Austria, Italy and Germany, more than a third of imports account for gas, etc [10].

The share of net imports in the EU's gross domestic energy consumption in 2020 was 57,5%, compared to 47% in 2000. Thus, the EU's dependence on external energy supply is increasing and this has a negative impact on energy security. Another problematic issue is obtaining

Table 4

EU dependency on imports of primary energy sources (% of imports into EU-28)

Countries	Period									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hard coal										
Russian Federation	21.9	20.2	23.9	25.1	26.4	28.7	35,4	39,5	43.5	49.1
USA	16.6	20.7	18.5	17.0	12.4	11.9	14.8	17.3	16.8	15.2
Australia	8.2	8.0	8.8	7.5	11.1	15.3	10.8	11.0	13.1	13.5
Colombia	18.6	19.1	16.4	17.0	19.3	18.7	15.9	12.6	7.7	5.4
Canada	2.3	1.9	2.1	3.1	1.6	2.3	2.4	2.4	2.2	2.3
South Africa	8.6	7.4	7.1	9.1	7.7	5.1	4.7	2.7	2.7	1.2
Others	23,8	22.7	23.2	21.2	21.5	18.0	16.0	14.5	14.0	13.3
Crude oil										
Russian Federation	35.1	33.9	34.5	31.4	29.7	32.4	30.7	29.6	26.8	25.7
Norway	7.2	6.8	8.1	9.2	8.4	7.9	7.7	7.2	6.9	8.7
Kazakhstan	5.9	5.3	6.0	6.7	6.8	7.0	7.6	7.1	7.3	8.4
USA	0.0	0.0	0.0	0.0	0.2	0.6	0.9	2.4	5.2	8.1
Saudi Arabia	8.3	9.1	8.7	9.0	7.9	7.7	6.5	7.4	7.7	7.8
Nigeria	5.6	7.2	7.2	8.3	7.7	5.2	5.8	7.0	7.8	7/7
Iraq	3.7	4.3	3.8	4.8	7.8	8.5	8.4	8.6	8.9	6.6
Unaited Kingdom	4.5	4.4	4.2	4.2	4.0	4.1	4.1	3.9	4.9	5.6
Azerbaijan	5.1	4.0	5.0	4.6	5.3	4.6	4.6	4.6	4.5	4.6
Others	24.5	24.9	22.5	21.8	22.4	22.0	23.6	22.4	20.0	16.7
Natural and liquefied natural gas										
Russian Federation	32.2	31.9	36.6	33.3	33.6	39.6	38.4	37.9	38.0	38.2
Norway	19.4	21.1	19.0	21.0	20.7	16.3	16.6	16.1	14.7	18.5
Algeria	12.2	12.1	11.1	10.5	9.5	12.3	10.5	10.8	7.2	7.5
Qatar	5.1	3.9	3.4	3.0	3.3	3.0	3.8	4.2	5.0	4.2
USA	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.6	2.9	4.0
Unaited Kingdom	3.6	2.9	2.5	2.7	3.4	2.5	2.3	2.2	2.5	3.4
Nigeria	3.8	2.9	1.5	1.3	1.8	2.0	2.5	2.6	3.3	3.0
Libya	0.6	1.7	1.5	1.9	1.9	1.3	1.1	1.1	1.3	1.1
Others	23.1	23.3	24.4	26.3	25.9	23.0	24.5	24.6	25.1	20.1

Source: compiled by the authors according to Eurostat

Table 5

Natural gas imports by EU partner countries, mln cubic meters

Countries	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Serbia	1,75	1,79	1,89	1,40	1,74	1,80	1,88	2,20	2,26	2,00
Turkey	43,88	45,92	45,27	49,26	48,43	46,35	55,25	50,28	45,21	48,13
Moldova	1,15	1,10	1,03	1,05	1,01	1,04	1,03	1,13	1,01	1,06
Ukraine	44,04	32,37	27,50	19,13	16,17	10,72	13,71	10,30	11,58	9,00
Georgia	н/д	н/д	1,91	2,18	2,50	2,26	2,34	2,36	2,69	2,69

Source: compiled by the authors according to Eurostat

energy supplies through partner countries and importing the product nomenclature. As Table 5 shows, Turkey and Ukraine have a high level of dependence on gas imports. At the same time, Ukraine's gas transportation system (GTS) provides for the import of Russian gas to EU countries, and this is another difficult moment in ensuring energy security because of systematic disputes between Ukraine and the Russian Federation.

Central and Eastern Europe face two major challenges in the energy sector: the need for reliable energy supply and insufficient infrastructure to secure the supply of these energy resources. These challenges are interconnected, for example, when existing infrastructure configurations turn into unwanted risks of energy dependency on any particular provider, especially when that provider is inclined to use the tool at a diplomatic level. These circumstances gave impetus to the diversification of the energy supply [11].

Joint projects and solidarity. To identify coherence between the level of threats to the EU's economic security and projects aimed at overcoming them with the participation of partner countries, an analysis of projects in the field of energy for the Eastern Partnership countries by type of cooperation, thematic zones was carried out.

According to HiQSTEP Project, since 1998, there have been 443 Eastern Partnership energy projects donated by institutions, agencies, and profile organizations of the EU as a whole and other countries in the world [12]. According to the structure of invested capital, preference is given to such types of cooperation as technical assistance, investment support, consulting and infrastructure development (Figure 1).

The analysis of projects by topic area revealed that energy efficiency, nuclear and energy security are the focus. 33, 23 and 22% of the funds were invested in projects in these areas respectively. According to the factor analysis, the most significant impacts on the EU's economic security, among others, are energy efficiency (primary energy consumption), renewable energy development and emissions (Figure 2). EU is focusing its efforts on overcoming challenges and minimizing risks through a policy of solidarity.

If to examine the process of selecting and investing in the Eastern Partnership projects through the prism of risk management, the following trend is outlined. The lion's share of almost 80% is intended for the implementation of technical methods of risk management. The preventive measures of management risks embrace consultations, the transmission of experience, studies and others like that. On them, it is distinguished to the 6,3 volume of financing.

Organizational risk management measures include assistance to ministries and agencies, support for reforms, methodological support, program development, documentation improvement, licensing, project evaluation, etc.). They account for 1.3% of the allocation.

It is worth mentioning another method of risk management – providing guarantees. The EIB Guarantee uses International Banking Reconstruction and Development (IBRD), covering five IBRD investment loans in Ukraine.

Through the influence of the relevant institutions, the EU manages economic security risks with the involvement of partner countries (Eastern Partnership countries), which in turn, through transit location and critical infrastructure, provide energy supplies, participate in their diversification, modernization and modernization, energy efficiency and other measures that are moving towards the achievement

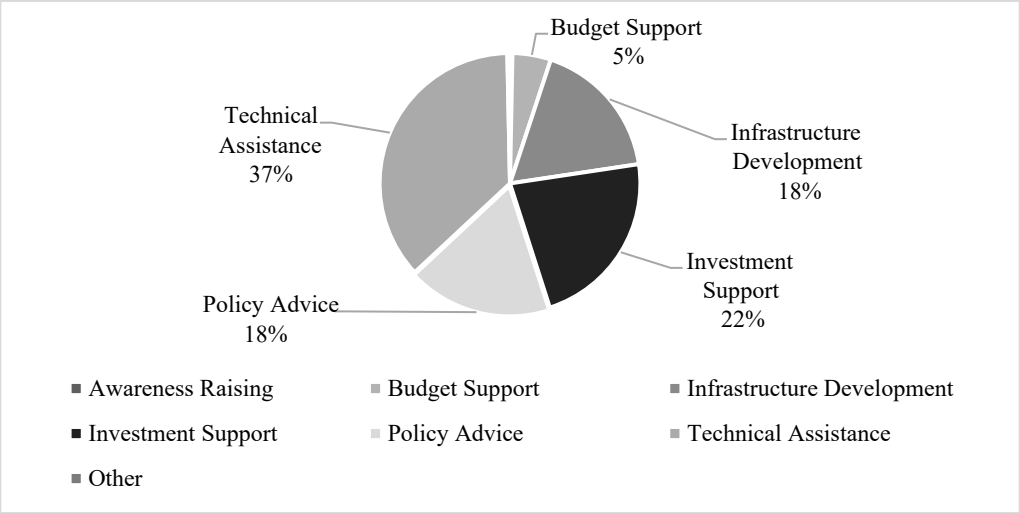

Figure 1. Structure of Eastern Partnership projects by types of cooperation, invested capital in %

Source: compiled by HiQSTEP Project (2020)

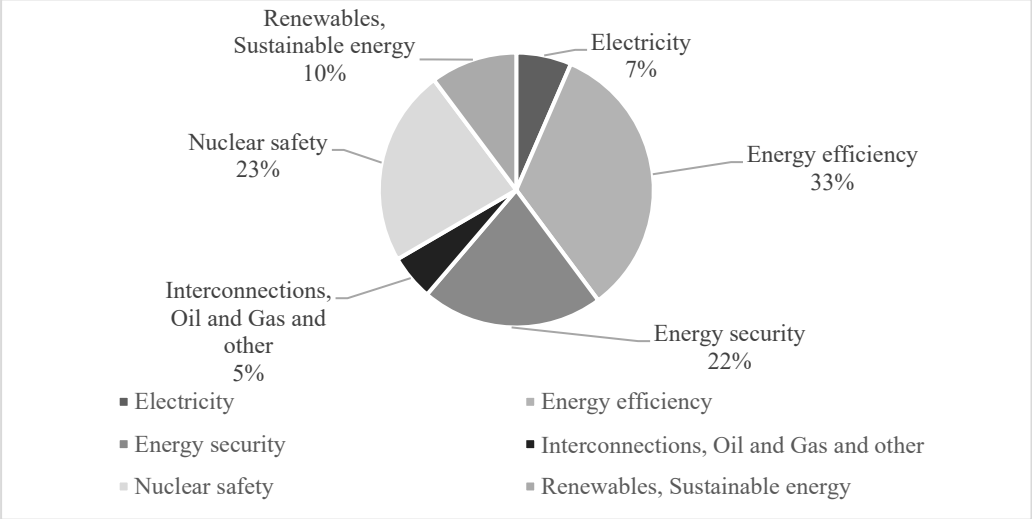

Figure 2. Structure of Eastern Partnership projects by topic area, % invested capital

Source: compiled by HiQSTEP Project (2020)

of the Sustainable Development Goals and the national development and Europe 2020 strategies.

European Energy Security Policy. European energy policy has three main components: competition, cooperation and solidarity, which shape a certain ideology and principles of energy security at the regional level. EU competitive energy policy aims to develop rules and processes to set priorities in the face of risk. Using competition as a tool for liberalizing electricity and gas markets, the European Commission started adopting directives in the 1990s. It ensures a more competitive, integrated market, offering consumers more choice [13]. Europe 2020 goals cannot be achieved without expanding partnerships with neighbouring countries.

That is why the principles of energy security – competition, solidarity and cooperation serve as a cornerstone of a holistic energy security mechanism with integrated levers of influence on its state through the system of financing, technical assistance, grants, consultations, etc. (Figure 3).

The EU energy security mechanism should be understood as a set of principles, forms of financing risk management projects based on the implementation of strategies, regulations, rules and directives of an interdisciplinary nature, with the fundamental foundations of economic security being solidarity, competition and partnership. They are interpreted not only for the national economies of the EU but are relevant for partner countries in the field of energy interests.

As a tool for counteracting economic security risks, energy solidarity is manifested through a set of goals that serve as a roadmap for balancing the interests of the region by ensuring the principle of solidarity in various joint projects aimed at enhancing economic security [14; 15] (Table 6).

Energy solidarity should be understood as a set of goals, principles, tools, initiatives and behaviours of energy market participants whose purpose is not only to provide energy and meet the needs of energy production, transit, redistribution and consumption, but to meet the needs of all stakeholders in providing energy security in response to emerging threats (including political origin) by managing profile risks in the context of regional needs.

Table 6

Targets and expected results of energy security policies in the risk management system

Target	Potential risks	Theme Zone projects	Expected results
Formation and development of domestic gas and electricity markets	Fall in demand	Energy security	Balancing demand for production capacity
Ensuring reliable supply of energy resources	Supply interruptions	Interconnections, Oil and Gas and other Electricity	Meeting demand through an advanced infrastructure of integrated grids
Optimization of energy use	Climate change, environmental	Energy efficiency	The renewable energy sources development and diversification
Collective approaches and broad cooperation in risky policy areas.	Political, organizational	Policy Advice in all thematic areas	Prevention of destructive decisions and actions
Taking into account the imbalance in the levels of economic and social countries development	Technical, technological	Nuclear safety Renewables, Sustainable energy	Realization of the European energy goals in the field of sustainable development

Source: developed by the authors

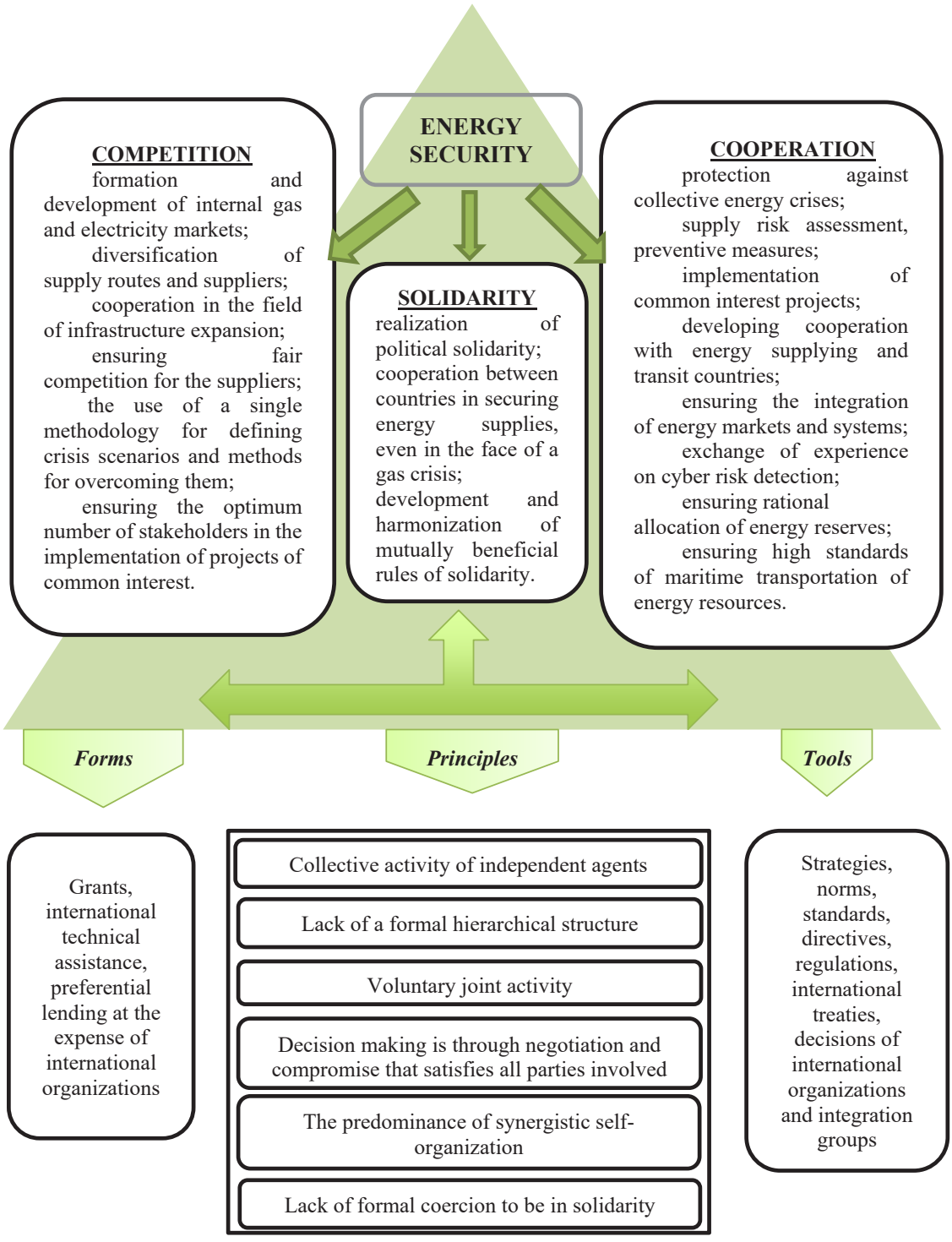

Figure 3. EU energy security mechanism

Source: developed by the authors

Conclusions. Significant EU experience in the form of strategies, directives, standards, and conditions shapes institutional support for managing energy security risks, enhances the competitiveness of national economies and promotes competition and the development of energy solidarity.

The results of correlation and regression analysis of the dependence of the total energy intensity of the EU countries on the most significant social, environmental, and resource factors and the obtained econometric models demonstrated the close level of relationships between such energy security indicators: primary energy resources, closed gas reserves, the share of energy produced using renewable energy sources.

The study of energy security risk management tools suggests that an important role in this area is played by the institutional approach, which is manifested through a number of directives, regulations, guidelines and enables regulatory processes in the industry both at the EU level

and with partner countries, including energy solidarity, cooperation and free competition. The regional approach and taking into account the economic opportunities of the recipient countries in the allocation of financial resources take into account the principle of energy solidarity and aims to overcome contradictions in the provision of energy supply processes.

Countries can make significant progress in protecting their energy security by joining forces and consolidating the main goals of energy strategies. By setting clear strategic goals, governments can help make the necessary changes for the efficient use of energy. Targeted settings of the EU profile policy (ensuring a reliable supply of energy resources, optimization of energy use, collective approaches and broad cooperation in risky policy areas) allow for minimizing the negative consequences of the realization of energy security risks by attracting appropriate instruments and forms of financing.

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