Sumy Region Economic and Energy Security Formation on the Biofuels Base*

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The article observes and systematizes the main approaches to define economic and energy security concepts, shows their peculiarities and specific features. The author's definition of region economic and energy security is offered. The strategic direction and a variant for the national and regional economy innovative development within it, in the context its economic and energy security provision is determined. The innovative transformations perspectives are economically grounded in state and region, based on introduction and extension of the technologies to use solid biofuel. The system of motivating actions, oriented to speed up innovative processes in national energetic sector, at state and regional levels, are suggested.

Key words: economic security, energy security, innovative development, risk, threats, social-ecological and economic efficiency.

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Problem statement. In recent years the problem to provide stable system of the national security in Ukraine in the part of economic and energetic independence, is growing and attracts special urgency. Under conditions of the Ukrainian dependence on the natural gas import, energy carriers diversification process gets high urgency and is oriented to reduce gas import amounts through local fuel types using. It is necessary to form new paradigm of knowledge concerning economic and energy security control at the national and regional levels taking into account sustainable development principles.

Analysis of the recent research and publications. Theoretical and practical questions to control the economic security are widely represented in works of such scientists as: M. Bendikov [1], A. Besedin [2], S. Illyashenko [8], E. Kamyshnikova [10, 11], R. Kvasnytska [14] and others. The issues of energy security are examined in papers of such scientists as: G. Bondarenko, Scherba V.O. [3], M. Zemlyany [7], V. Mykytenko [19], I. Plachkov [22], Y. Prodan, B. Stogniy [25], Y. Samoleynko [28], A. Smenkovsky [29] and others.

Although there are profound and significant scientific achievements on the mentioned problems, this problem has not been totally studied. The problem to form complex approach to

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the end-to-end control of economic and energy security in the state and its regions, particularly in the context of sustainable development, has not been studied yet.

The object of the article is to study perspectives to form economic and energy security, based on biofuel, in Sumy region. There are the following tasks: to investigate and to systematize economic and energy security concepts; to ground economically the most strategic directions and within them – variants of the ecologically oriented innovative development, directed to provide economic and energy security of the national and regional economy, to study opportunity to realize them in Ukraine and in Sumy region; to develop motivating actions, oriented to fasten innovative processes in the national energetic sector, at the state and regional levels.

Results of the study. Observing the economic and energy security concepts, we distinguish main approaches to define their essence (fig. 1).

The economic and energy security as a state of resources effective use was observed by the following researchers: Pokropyvny S. F [6], Illyashenko S. M. [8], Oleynikov E. A. [20]. In the similar realization of security, one does not focus on threats absence, but on the economic entity's high economic potential provision through organization of the most effective work of its departments. Such an approach clearly defines main terms to provide economic and energy security, determined by the efficiency level to use current resources in terms of all spheres in economic activity. However, within the given approach, the main attention is focused on the internal environment of the economic entity. At the same time many factors of the external impact, nature and dynamics of the social and economic and market environment, which mostly determine the resources and their efficient use, are left out of account.

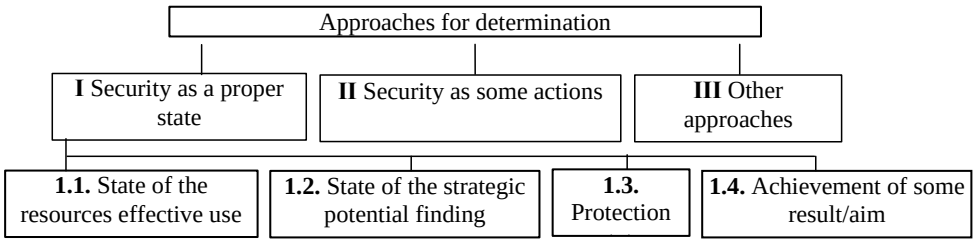

Figure 1. Approaches to determine concepts of the economic and ecology security (investigated by authors)

Korniyenko A. V. [17] and Sokolenko T. M [30] observe economic and energy security in their works as a state of the strategic potential finding. In this context security is defined as a state, in which economic entity's strategic potential is located near adaptiveness borders, and a threat to lose economic security is growing to the extent of strategic potential adaptive degree proximity to the boundary zone [30].

Byendikov M. A. [1], Dubetska S. P. [5], Voronovych L. M [4], Sukhorukova T. I. [15] and Lyanny G. G. [18] observed in their papers the economic and energy security concept as a state of enterprise, region and state protection. Such approach describes fundamental feature of the security – absence of interests clash, or absence of crisis state features. Although, the security concept really foresees absence of danger, i.e. any threats, according to authors' views, the similar approach to define security is wrong. The economic security of the enterprise has to foresee not only threats (risks) avoiding and adaptation to the external

economic conditions, but first of all the economic evolution of the business entity as a system, to realize its economic growth strategy, economic potential increase considering risks, threats and environmental tendencies. Narrow understanding of security is based on the fact of the absence of economic activity threats at the given moment. It can be preconditioned by the available market conjuncture. At the same time, for example, low financial stability of the enterprise, technological lagging and high level of main producing funds loss, leaves open the possibility of economic entity's bankruptcy with a little change in environmental parameters.

The economic and energy security as a complex of actions is shown in [12, 24, 26]. Within the given approach the main attention is focused on actions complex and factors, which don't consider necessity to prevent from internal and external threats for the security subject, and as it is mentioned in [24], processes, methods, tools to reveal, to alert, to prevent from threats and conflicts with purpose to investigate such acts. That's why such approach is limited and incomplete, because it does not consider several important factors of the economic subjects' activity.

Besides main approaches to define economic and energy security essence, mentioned above, such scientists as Sally V. I. [27], Tymofeyev T. V., Kozachenko G. V. [16], Pilova D. P [21] and Shemayeva L. G. [31] understand the essence of these concepts in another way. They observe these concepts as some result achievement (desired level of production and economic factors) or goal under existing conditions of macro- and microenvironment. One the one hand, such approach takes into account peculiarities of the economic entity, specific nature of its activity, its mission and other significant factors. On the other hand, disadvantages of such approach can be wrong formed plans and strategies of the economic entity's development. It can lead to wrong actions or inadequate reaction for prevention of these or those threats and risks.

However, although there are various aspects, within which the economic and energy concepts are observed, there is a conclusion that none of the observed definitions can't be simplified or be agreed with. Some authors see the security concept widely, others - narrowly, that excludes possibility of the complex approach to its estimation.

Having analyzed the existing views to the economic and ecology security concepts, it is reasonably to propose definition, which represents its essence more clearly and totally.

If we consider the economic and energy security of the economic entity subject, the given concept is understood as an absence of any economic and energy threats in the economic activity, particularly force-majeure, which are more often preconditioned with natural, geographical, political and other global and natural factors; and also systematic prognosticated cyclic threats, defined by market, macroeconomic, scientific and technical external factors, and by efficiency of productive and economic activity organization and controlling system.

Thus, taking into account the motioned above, *economic and energy security of the region* is suggested to determine as a state of its recourses most effective use (including energy) to provide its sustainable development and an ability to overcome the dangerous factors impact from external and internal environment with purpose to build effective interrelations between economic activity subjects both on its territory and outside.

It should be mentioned that normal state of the economic security in the region is achieved with the most effective use of its resources and with correspondence between its development course and main tendencies in the environment, strategic courses of the ecologically oriented innovative development of the state and region.

The author's methodical approach is used to define the top-priority course of the ecologically oriented innovative development of the economic entities at the state and regional

levels, based on analysis of the most significant external and internal factors (in more details see [13]), let see the necessity to activate and to develop the variant for production and use of alternative power source – solid biomass (solid biofuel), in Ukraine and particularly in Sumy region, within the strategic direction "Ecological Systematic Innovations". The studies that show this ecologically oriented innovative development direction realization will allow to increase energy security of the national economy by 40 % and economic security – by 25 %.

Sumy region has great reserves on production of the alternative fuels, based on agricultural production wastes, forest husbandry and woodworking. Annually straw wastes amounts (barley, beech wheat, wheat, oat etc) comprise almost 600 thousand tons, wastes amounts of all forest husbandry and woodworking enterprises activity – about 153 thousand cubic meters, which can be directed to the alternative fuels production [13].

The investigations, carried out by authors, showed that in order to realize the suggested variant to produce and to use alternative renewing fuels, it is necessary to introduce the following actions:

– to set equipment to compact and to transport straw, and also to create productive capacities to produce alternative fuel (wood briquettes and pellets) from straw and wood wastes (according to the calculations, it is necessary to locate 90 centers for wood briquettes production in Sumy region (7 centers in regions have been already located));

– to equip additionally boiler stations in the state buildings and economic entities with solid fuel boilers (it is required to substitute heated boilers in Sumy region that includes 51430 boilers for household consumers, 329 boilers for state buildings);

– to create self-supporting laboratories to control the quality of the wood briquettes.

Besides, realization of the mentioned variant requires to conduct such additional actions as: modernization of the heat and power equipment and heating pipe networks; heat proof of houses.

The analysis of the variant concerning activity introduction on solid fuel production – wood briquettes showed that during ecological and economic cycle there are the following risks:

I. At the stages of the innovative cycle: excess of expenses over the planned expenditure; delay of project, installation and building and preparation works; political and legal risks;

II. At the stages of the market cycle: non-delivery of raw material and resources outgoings; price risks; reducing of shipping skids sales amounts; income deficiency; man-made risks; extra expenses for liquidation of the burst releases and production accidents.

Besides, on the basis of marketing environment factors investigation, technical conditions and limitations concerning the existing infrastructural provision, it was defined that realizing the mentioned variant, the following actions are possible:

1. *Optimistic* (it is planned to fill productive capacities for 84–85 % during the first year. During the second year, production works at all capacity – 12 thousand tons of pellets per year. Starting with the third year, besides the main activity on production of the pellets, it is planned to introduce laboratory service. Owing to profits, provided by the main and additional activity, it is planned to create own developed infrastructure (reception stations of raw material, given by citizens, and its keeping, transport park to transfer raw material and final production from places where it is formed (collected) to the plant on processing). It will let to avoid risk not to receive outward raw material to supply the productive process. Therefore due to the previous estimations the annual inflation level will be 8–10 %);

2. *The most probable* (in the first production year it is planned to involve productive

capacities by 84%. Starting from the second year, production works at full capacity. Starting from the third year, besides main activity on production of fuel pellets, it is planned to introduce service of the complex laboratory and to develop own infrastructural provision. The annual level of inflation is prognosticated within 11–12 %);

3. *Pessimistic* (during the first year of production, it is planned to involve productive capacities by 80 %. Starting from the second year, regional complex works at full capacity. Economic situation instability is prognosticated in Ukraine, annual inflation level exceeds 16 %).

Integral discount estimation of the project realization risk, carried out due to methods, showed in the work [9], has been formed for different prognostications variants: due to the optimistic prognostication – 304 thousand dollars, due to the most probable prognostication – 375 thousand dollars, due to the pessimistic prognostication – 521.8 thousand dollars. Therefore the expected risk level takes place in the minimal risk zone by all prognostication variants. It proves the project efficiency and its introduction reasonability.

It should be mentioned that introduction of activity on solid biofuel production and using in Sumy region will let to get the following effects:

1. Economic effects:

1.1. Reducing of the natural gas consumption (annual economic effect from the difference between fuel prices will be 302.5 mln. UAH under conditions of the alterative renewing fuels use in Sumy region to the extent of total value 270.6 mln. UAH. It will let to substitute consumption of 301 mln cubic meters of the natural gas, taking into account thermal conductivity. Amounts of natural gas consumption reducing in Sumy region will be decreased by 420 mln cubic meters till 2025, by such categories as communal thermal energy sector, governmental organizations, and population – by 266 mln cubic meters. Gas saving amounts in Sumy cities and regions till 2025 are presented in the table 1.).

1.2. Creation of the additional commercial products in agricultural and forest husbandries, not less than 270 mln. UAH annually.

Table 1

Gas saving potential in cities of Sumy region till 2025 (according to [13])

City	Population in 2007, thousand persons	Expenses of gas, thousand m^3	Including			Expense per capita, thousand m^3	Prognostication of gas expenses in 2025 per 1 citizen, thousand m^3	Prognostication of expenses for gas in 2025, thousand m^3
			Population	Enterprises	Government sphere			
Sumy	280	237274	95517	136306	5451	0.85	0.43	120400
Konotop	95	53861	29892	22475	1494	0.57	0.43	40850
Shostka	82	65690	22731	42400	559	0.80	0.43	35260
Romny	47	40611	32007	8174	430	0.86	0.43	20210
Okhtyrka	50	45775	30898	13796	1081	0.92	0.43	21500
Hlukhiv	36	22533	13854	7639	1040	0.63	0.43	15480
Lebedyn	27	24588	21186	3030	372	0.91	0.43	11610
Total in regional cities	**617**	**490332**	**246085**	**233820**	**10427**	**0.80**	**0.43**	**265310**

2. Social effects:

2.1. Creation of over 2.5 thousand working places in urban area.

2.2. Achievements of the practical experience to introduce such activity in other Ukrainian regions.

3. Ecological effects:

3.1. Prevention of carbonic oxide emissions into the atmosphere, and hence, preservation of ozone layer in the atmosphere;

3.2. Reducing of sulfur emissions into the atmosphere (sulfur emissions amount is reduced to 0,032 % during wood briquettes burning unlike natural gas burning, that does not pollute air);

3.3. Reducing of the wood briquettes burning wastes utilization (ash vestiges comprise 1 %, coal ash vestiges – 30–40 %, wood – 8–15 %).

The authors' calculations show that expected social, ecological and economic efficiency of the mentioned variant for the enterprise during economic and ecological cycle of ecoinnovations (E_{CEE}), lasting 18–40 years (according to technique, described in [25]), is 1.96. Dispersion of the efficiency factor E_{CEE} for regional enterprises depends on their location place, access to the raw-materials, the consistent market infrastructure development level and potential capacity of the wood briquettes local market. For Sumy region districts the measure of E_{CEE} is $E_{CEE} = \{1{,}88;2{,}03\}$ in Sumy and Konotop districts, $E_{CEE} = \{1{,}82;1{,}99\}$ in Bilopilya, Buryn, Velykopysarivka, Glukhiv, Krasnopilya, Lebedyn, Nedryhayliv, Okhtyrka and Romny districts, $E_{CEE} = \{1{,}77;1{,}85\}$ in Krolevets, Lypovadolyna, Putyvl, Seredyna-Buda, Trostyanets, Shostka and Yampil districts.

In order to estimate commercial efficiency of the proposed variants realization, net present value *NPV* indices, internal rate of return *IRR,* profitability index *PI* and payback period *PP* are calculated, considering risk factors due to three variants of prognostication. The expected indices of the commercial efficiency to realize a variant on wood briquettes production and their use in Sumy region, calculated for the period 18 years with discount rate 20 % considering risk due to three prognostication variants, are high. In particulary, NPV fluctuates within 5.03–9.73 mln UAN ($NPV_{the\ most\ probable}$ = 7.48 mln. UAH); IRR fluctuates within 28.7–51.5 % ($IRR_{the\ most\ probable}$=35.18 %); PI fluctuates within 1.66–2.08 ($PI_{the\ most\ probable}$=1.83); PP fluctuates within 10.95–7.25 years ($PP_{the\ most\ probable}$=8.84 years). More detail evaluations of all mention estimates are represented in papers [13, 32].

Thus, calculation shows that the proposed variant of the ecologically oriented innovative development is highly effective by all prognosticated scenarios. High internal norm of the variant payback lets to conclude that it is reasonable to be realized even under conditions of the credit involvement.

It is necessary to involve governmental and local authorities', investors' and citizens' funds to organize production of the local renewing fuels in order to provide main technologies and other equipment. Therefore State budget funds are proposed to finance the following activities:

- establishment of lines on fuel bricks production in Sumy regions;
- refund of discount rate for economic entities' credits to create manufacturing lines in order to produce pellets and wood briquettes;
- cofinancing with local budgets, arrangement of the government sector boiler houses and communal thermal energy sector with boilers for solid fuel use;
- credits easing for domestic equipment;

– cheapening of the price for solid fuel boilers for citizens.

One of the alternative variants to finance the strategy direction is to receive credit (open credit line) within necessary investment resources amounts. Therefore the following form of credit reimbursement is foreseen: monthly reassessment of percentages from the financing start; main debt repayment of the credit is carried out according to the credit service schedule, which will be formed in the process of agreements coordination and signing with producers/suppliers of the technological equipment for plants.

Another way to finance this variant of the regional innovative development is to get several credits (opening of few credit lines) through foreign investment funds, which promote technologies, goods and service of own producers to the international markets, in such a way.

Besides, one can use money from State environment protection fund and project participants' own resources to realize the project.

The financing source choice of the mentioned innovative project depends on its efficiency indices calculations, defined under condition of each variant involvement. Such calculations fairness is preconditioned with time aspect of the project carrying out, and also with right estimation of the innovative product consumer's potential at the market.

With the purpose to encourage the wood briquettes production, consistent infrastructure formation, consumers' stimulation to their use and technical re-equipment of the heating system, authors suggest to introduce several actions for state support of the mentioned variant (within strategic direction "Ecological Systematic Innovations") and fulfillment at the state and regional level, based on exploration of innovative processes stimulation used in the different countries (particularly, in the USA, Germany, Great Britain, Italy, France, Japan, Canada, Brazil, Israel, Australia):

– establishment of the additional levy for oil and natural gas of the domestic mining with amount 2% with its further transfer to the special fund in state budget. The main goal of the fund is to finance the pilot projects on production and use of the alternative fuels in the regions of Ukraine;

– reducing of credits rates through compensation of the long-term credits, involved economic entities to purchase equipment to produce fuel from wood husbandry wastes, agricultural production (straw) and woodworking industry (the order is developed);

– subventions from state funds to compensate houses equipping with solid wood briquettes for private individuals , which work on local renewing fuels.

It is economically preconditioned that the proposed actions use will let to increase socio-ecological and economic efficiency of considered strategy direction at the regional level from 2.02 to 2.3 (by 13,9 %) owing to the impact on ecological component.

According to the prognosticated calculations, state support and introduction of the proper state policy, regulation of the legal and regulatory aspects will reduce the duration of innovative and investment cycle and fast transferring to the growth stage, duration of which has long-term perspective. It will allow to solve a problem concerning fast return of the invested resources, rational nature management, provision of the constant financing source of the nature protection events owing to the proper fund storing, decrease of the tax impact on the economic entities concerning tax for environmental pollution through taxing base extension.

Conclusions and perspectives for further scientific investigations. The results of the study let to confirm that in order to solve a problem to provide national security in Ukraine, great reconstruction in the energy sector in Ukraine, based on ecoinnovations introduction, is one of the important and top-priority issues. Activation of the innovative process in this

branch on the basis of crop growing and wood industry wastes processing and production of the fuel bricks and shipping skids, will assist to decrease ecodestructive load on the environment and to supply native consumers with highly qualitative energetic resources. The received results allow to form end-to-end system to control energetic sphere in future, considering socio-economic motivation of all branches ecologization in the native economy and prognostications of changes in the economic and energy security at the state and regional levels.

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Формування економічної та енергетичної безпеки Сумської області на основі біопалива

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У статті досліджено та систематизовано основні підходи до визначення понять економічної та енергетичної безпеки, розкрито їх особливості та специфічні риси. Запропоновано авторське визначення економічної та енергетичної безпеки регіону. Визначено пріоритетній напрям, а в його рамках – варіанти інноваційного розвитку національної та регіональної економіки у контексті забезпечення їх економічної та енергетичної безпеки. Запропоновано систему заходів, необхідних для реалізації запропонованого варіанту з виробництва і використання альтернативних поновлювальних видів палива. Економічно обґрунтовано перспективи інноваційних перетворень у державі та регіоні на основі впровадження та поширення технологій використання твердого біопалива. Запропоновано систему мотивуючих заходів, спрямованих на прискорення інноваційних процесів у національному енергетичному секторі, на державному та регіональному рівнях.

Ключові слова: економічна безпека, енергетична безпека, інноваційний розвиток, ризик, загрози, соціо-еколого-економічна ефективність.

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Формирование экономической и энергетической безопасности Сумской области на основе биотоплива

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В статье исследованы и систематизированы основные подходы к определению понятий экономической и энергетической безопасности, раскрыты их особенности и специфические черты. Предложено авторское определение экономической и энергетической безопасности региона. Определено приоритетное направление, а в его рамках – варианты инновационного развития национальной и региональной экономики в контексте обеспечения их экономической и энергетической безопасности. Предложена система мер, необходимых для реализации предложенного варианта по производству и использованию альтернативных возобновляемых видов топлива. Экономически обоснованы перспективы инновационных преобразований в государстве и его регионах на основе внедрения и распространения технологий использования твердого биотоплива. Предложена система мотивирующих мероприятий, направленных на ускорение инновационных процессов в национальном энергетическом секторе на государственном и региональном уровнях.

Ключевые слова: экономическая безопасность, энергетическая безопасность, инновационое развитие, риск, угрозы, социо-эколого-экономическая эффективность.

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