Strategy for the Development of Bioenergy Based on Agriculture: Case for Ukraine

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Received: 30.04.2020 Accepted: 01.06.2020

Abstract- The development of biofuel engineering on the basis of agriculture is one of the main strategic directions of the use of alternative power sources. Renewable power engineering on the basis of agriculture serves as the ground for development of agricultural territories, agricultural diversification, technological equipment and innovative development of the branch and securing power independence of the country. The article analyses main trends of biofuel engineering development in Ukraine. We have built a forecast of change development pace of biofuel production in Ukraine up to 2025. We have conducted complex PEST analysis of long-term benefits of biofuel engineering market in Ukraine. We have substantiated main tendencies of strategic changes in the branch within the limits of the most influential outer impact factors related to the development of renewable power engineering. We have conducted analysis by separating the factors that have positive and negative effect on the process under study. We have offered a complex of strategic activities within the limits of the most influential environmental factors. The novelty of this research is the creation of a strategy for the development of agriculture-based biofuel production in Ukraine using an innovative approach based on the Hoshin Kanri matrix. It is based on the implementation of Deming Cycle and presents the concept of cycle management. On the basis of developed strategy we have outlined main strategic targets, processes and results. Among primary strategic targets we have singled out the following: the improvement of economic and law mechanism of state policy of the development of biofuel engineering; the increase of the volumes of attracting domestic and foreign investments; the implementation of innovative biofuel engineering technologies in industry; raising social awareness level for business and population. In order to optimize the implementation of the strategy development we have established correlation connections between the elements of the strategy. We have outlined the margin of biofuel engineering development at agricultural enterprises according to blue ocean strategy. The results obtained serve as the ground for further investigations of biofuel engineering development on the basis of agriculture.

Keywords-biofuel engineering on the basis of agriculture, renewable power engineering, strategic analysis, Hoshin Kanri, Ukraine.

1. Introduction

Contemporary environmental issues [1] constitute one of the primary reasons of the development of alternative power sources [2-6], namely, the development of biofuel engineering on the basis of agriculture [7-11], compared to traditional sources.

The use of traditional energy sources can cause a set of problems. Firstly, common energy cannot be renewed and its overuse can cause severe energy crisis which is the reason of a big concern in the world. Secondly, the use of traditional energy sources leads to the acceleration of global warming, for example, the increase of carbon dioxide and other greenhouse gases. Thirdly, separated nitrogen oxides obtained as a result of extracted fuel burning put at risk the quality of air and harm people's health [12].

Among the countries with low level of economic development Ukraine is viewed as a country with undeveloped market of renewable energy but it is characterized by high level of scientific potential on the basis of a big number of universities and research institutes [13]. Renewable power engineering is an important strategic niche of the development of national economy of Ukraine, able to influence power safety of the country, create new working places and ensure economic growth as a whole. Besides, it plays an important part in the development of Gross Domestic Product. It is necessary to implement contemporary management methods in the development of biofuel power engineering with the purpose to adjust to all external factors that are constantly changing [14].

On a global scale the development of biofuel power engineering is the most important renewable energy source and is considered to be one of the approaches aimed at reduction of global greenhouse gases emission [15]. In the EU, energy from biomass and the renewable share of waste contributes to almost two thirds of the primary combined renewable energy production today, and the absolute amount is expected to further increase slightly until 2030 [16]. This is why the urge for clear, stable, long-term priorities to ensure additional biofuel power engineering in different branches of power engineering (heat, power engineering and transportation) [17].

The problems and perspectives of the development of biofuel power engineering as an important branch of alternative power engineering and energy balance are investigated by different scientists from different countries, namely: case of Poland is underlined by N. Iwaszczuk, M. Szyba, A. Iwaszczuk [18], the USA's experience is stressed by Walter V. Reid, Mariam K. Ali, Christopher B. Field [19] and Evan S. Jones, Huangjie Gong, Dan M. Ionel [20], problems and perspectives of the development of biofuel power engineering in China is are disclosed by C. Z. Wu, X. L. Yin, Z. H. Yuan, Z. Q. Zhou, X. S. Zhuang [21], case of India is described by Lion Rajmohan, Sunita Varjani [22], the tendencies of the development of biofuel power engineering in Malasia are outlined by Jing Yan Tock, Chin Lin Lai, Keat Teong Lee, Kok Tat Tan, Subhash Bhatia [23], case of SAR is described by William Herbert Lee Stafford, George Adrian Lotter, Graham Paul von Maltitz, Alan Colin Brent [24], the use of biomass as an alternative energy source is explored in Turkey by Isik Semerci, Fatma Guler [25] and in Bangladesh by Sanwar Hossain, Fayzur Rahman [26], the opportunities of the development of the renewable energy in Spain is underlined by Daniel Icaza, David Borge-Diez [27].

Having taken into account the particularity of biofuel power engineering development in different countries scientists offer different solutions for existing problems. But most of them concentrate their attention on the fact that the main prerequisite of biofuel power engineering development is the design of active development strategy.

Investigating strategic directions of biofuel power engineering development scientists use different methods of strategic analysis and strategy construction, namely: SWOT analysis method [28-31], external analysis [32], STEPLE analysis method [33; 34] and roadmap method [35; 36], Monte Carlo analysis method [37].

Analysis of strategic documents for the development of the bioenergy sector in Ukraine [38] shows that the prospective goals are given in the New energy strategy of Ukraine until 2035: "Safety, energy efficiency, competitiveness". This strategy declares that by 2035 in Ukraine the volume of renewable energy production in the overall energy balance will be 25%. However, detailed methods to achieve this goal are not provided.

Summarizing current scientific achievements in the sphere of strategic planning of biofuel engineering development we draw the conclusion that modern power engineering needs precise strategic plan of biofuel engineering development on the basis of agriculture. We need to design strategic outline of agricultural enterprises activity factors in order to develop biofuel engineering branch. The presence of definitely outline strategy will make it possible to achieve clearly outlined goals, in addition to this to increase biofuel production volumes in Ukraine, broaden partnership relations, perfect management system that ultimately will result in the increase of power independence of the country.

That's why it is very important to conduct a detailed analysis of the state-of-the-art in the industry, prospects for its development, and create a clear strategy of biofuel production based on agriculture.

2. The analysis of biofuel engineering development tendencies in Ukraine

Over the last 20 years the tendencies of power production volumes from different energy sources as well as from renewable ones, namely biofuel, have been very unstable. Fig. 1 shows that from 1998 to 2013 the volumes of power production from different sources have gradually

increased, namely from 71 mtoe in 1998 to 86 mtoe. 2013. Starting from 2013 there has been gradual decrease in power production volumes, namely by 32% for the past 5 years (2014-2018) [39].

At the same time it is worth mentioning that the volumes of power production from renewable energy sources within the last 20 years (1998-2018) have remained stable at the level of 4,5-6 mtoe per year. Alongside with this it is worth mentioning that relative share of biofuel engineering in the balance of renewable sources remains insignificant – about 9%.

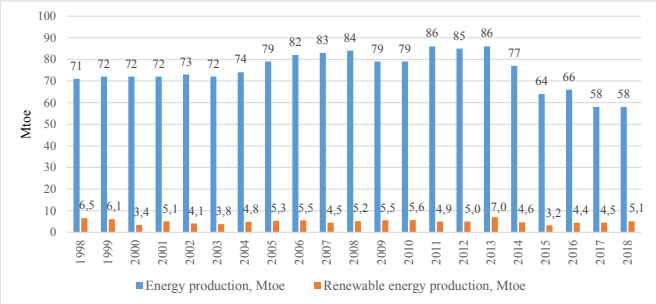

Fig. 1. Power production volumes (overall) and renewable energy in Ukraine during 1998-2018

There are several reasons of power production volumes decrease in Ukraine: firstly, orientation and transfer to imported power raw materials; secondly, slow speed of GDP growth volumes and as a result power consuming; thirdly, the absence of stability of power market regulations in Ukraine do not contribute a lot to the development and investments into this branch.

According to the investigation of the changes in production volumes we have designed the forecast of the changes of biofuel production volumes in Ukraine until 2025. The exponential dependence shown in Fig. 2 shows that according to the forecast biofuel power engineering production volumes will not be changing, moreover, they are likely to decrease slightly. Correlation ratio is not high and is equal to 0.17 that may testify that forecast values may slightly differ from factual ones.

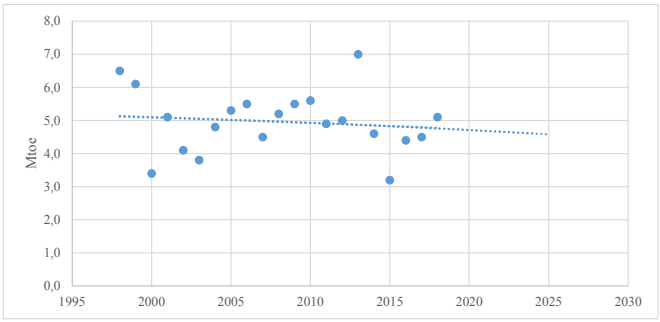

Fig. 2. The forecast of biofuel engineering production volumes in Ukraine until 2025

It is obvious that the given forecast of biofuel power engineering production volumes changes is rather pessimistic because the production volumes are almost at the same level. That is why taking into account high level of power dependence of modern Ukraine we need clear strategy of biofuel power engineering development as one of the primary branches of power engineering.

3. Strategic analysis of biofuel power engineering market development potential in Ukraine

In Ukraine there are present perspectives of technical character for the development of renewable power engineering and biofuel power engineering in particular. But it is obvious that there is a set of obstacles on the way to quick development of bioeconomics at present stage. In order to establish perspectives of the development of bioeconomics we have analyzed the outer conditions potential in relation to the given branch that either contribute or handicap the establishment of biofuel power engineering market in general. The conducted PEST analysis of the outlook of biofuel power engineering market development displayed as main perspective development directions for alternative engineering so as problematic aspects (Table 1).

Table 1. PEST analysis of the outlook of bioeconomics development in Ukraine

		Factor	Execution probability	Impact degree	Windowed estimate
Political	1	Changes in legislation in terms of biofuel power engineering regulation	0.12	4	0.48
	2	Legislation regulation of the development of separate kinds of alternative sources in Ukraine	0.12	4	0.48
	3	Providing state target aid to subjects that switch to biofuel power engineering	0.06	5	0.30
	4	Providing tax benefits to biofuel power producers	0.06	5	0.30
	5	The change of demands of environmental legislation	0.06	3	0.18

	6	Signing economic part of the Agreement about association between EU and Ukraine	0.10	4	0.40
	7	Removing red tape obstacles for business development, associated with biofuel power engineering	0.08	5	0.40
	8	Changing terms of obtaining imported traditional energy sources	0.20	4	0.80
	9	Power decentralization, administrative reorganization and the increase of financial independence of community	0.20	3	0.60
		Political factors	**1.00**	**X**	**3.94**
Economical	1	The implementation of stimulating "green tariff" for alternative power engineering, namely biofuel power engineering for a wide range of producers	0.06	5	0.30
	2	Changing prices for traditional (fossil) energy sources	0.16	4	0.64
	3	Active development of renewable power engineering and bioenergetics	0.08	5	0.40
	4	The enhance of industrial development, the increase of production volumes and resource consuming	0.10	3	0.30
	5	The increase of the volume of investments in economics	0.10	4	0.40
	6	The increase of the number of big enterprises in the region ready to invest in the development of their production technologies, namely in bioeconomics	0.08	5	0.40
	7	Inflation processes spreading	0.14	5	0.70
	8	Interest rate increase for loans in national currency	0.14	5	0.70
	9	Activating scientific and industrial cooperation in the development of biofuel power engineering with foreign partners	0.12	4	0.48
		Economic factors	**1.00**	**X**	**4.32**
Social	1	The income level of population (the ability to switch to homesteading by alternative power engineering)	0.20	5	1.0
	2	The readiness of population to switch to biofuel power engineering	0.16	3	0.48
	3	The increase of civil awareness in terms of the necessity of switching to alternative energy sources, namely to biofuel power engineering	0.16	3	0.48
	4	Migration processes spreading, namely brain drain of highly qualified staff	0.28	4	1.12
	5	The growth of social tension in the country	0.20	4	0.8
		Social factors	**1.00**	**X**	**3.88**
Technological	1	The presence of natural and climatic conditions for the development of biofuel power engineering	0.16	5	0.8
	2	The presence of technical and technological capacities for the development of biofuel power engineering	0.10	4	0.4

	4	The presence of inventions, patents for developments in the branch of biofuel power engineering development	0.12	3	0.36
	5	The presence of strong scientific potential for the development of renewable energy sources, namely biofuel power engineering	0.16	4	0.64
	6	Activation of the development of high-technology production	0.06	5	0.3
	7	Activation of operations of scientific and technological parks, industrial zones development	0.08	5	0.4
		Technological factors	**1.00**	**X**	**3.30**

The PEST analysis showed that the most influential factors affecting the process of establishment of biofuel power engineering in Ukraine are economic factors with power of influence ratio 4.32, as well as political ones – with the ratio 3.94. Next come social – 3.88 and technological – 3.30 (Fig. 3). The conducted analysis separated the factors that have positive and negative effect on the process under investigation. The values of the likelihood of occurrence and the level of effect show which factors should be taken into account first and those deserving less attention.

Final step of the analysis is shaping up all calculations into matrix. All influence factors are listed in descending order in final table of PEST analysis (Table 2).

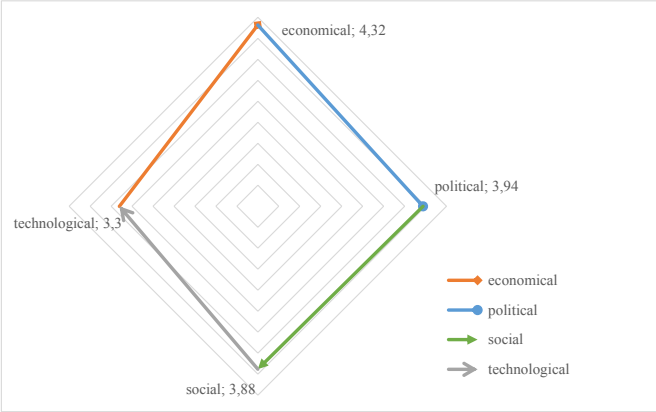

Fig. 3. The effect of the factors of biofuel power engineering prospects in Ukraine

Table 2. Final PEST analysis table of the prospects of biofuel power engineering in Ukraine

Factors	Changes in industry	Strategic measures
Political measures		
Enhancing of state support of renewable power engineering, namely biofuel power engineering	Increase of business profitability, possible increase of number of enterprises	Ensuring industrial growth at the expense of different state programs and subventions
Termination of military situation in the country	Stabilizing business activities, enhancement of international cooperation	Finding international partners and international expansion
Positive changes in legislation in terms of regulation enterprises activities in power engineering	Increase of branch profitability and the volumes of production	Raising social awareness of enterprise (especially in terms of paying taxes), pay rise
Removing red tape obstacles for business activities	Facilitating agricultural activities conditions	Adherence of fair business rules
Positive legislation changes in terms of environmental protection	Positive changes in the level of environmental protection	Construction and operation of waste treatment facilities, development of high technologies, ground erosion control
Economic factors		
Increase of investment volumes in power engineering, namely biofuel	Production volumes increase and	Paying attention to quality and high-

power engineering	industrial capacity increase	tech production
Improvement of business conditions if the country	Increase of number of agricultural enterprises associated with biofuel power engineering	Innovative development course, attracting home and foreign investments
Increase of investment prospects of the brunch	Increase of amount of investments in the branch	Goods quality increase, enhancing competitive advantages in order to attract investments
Growth of export-import operations with European countries	Emerging of new possibilities for biofuel power engineering enterprises	Goods quality increase, design of a new program of goods promotion
Increase of competitive advantages and lowering pressure from competitors	Development of "smart" competition in the branch	Seeking ways for maintaining top positions in the branch
Social factors		
Raising standards for power market	The increase of number of competitive enterprises	The improvement of quality of goods and services, enhancement of competitive advantages
Presence of staff and scientific potential for the development of biofuel power engineering	The increase of the number of innovative enterprises	Stimulating innovative activities
Raising interest in the development of renewable sources, namely biofuel ones among general public	The raise of price of power production from alternative sources, namely biofuel ones	Paying attention to the possibilities of saving public costs at the expense power production from alternative sources, namely biofuel ones
Positive changes of lifestyle and power consuming habits of the public	Drawing more attention to power production from alternative sources, namely biofuel ones	Raising social awareness so as to the possibilities of power production from alternative power sources, namely biofuel ones
Raising public revenue level (purchasing power)	Enhancement of branch profitability	The increase of production volumes, product-line expansion
Technological factors		
Presence of technical and technological capacities	The increase of industrial capacity volumes of the branch	The use of technical and technological capacities in order to achieve maximum possible production output
Activation of operation of scientific-technological parks	Activation of innovative activities on the branch	Introducing scientific and technological ideas in order to raise competitiveness of enterprises
Development of scientific investigations and engineering solutions	Branch modernization	The use of new "smart programs", modern IT-technologies
Activation of high-tech production development	Positive trends in branch development	Production equipment upgrade, production technologies development
Presence of inventions, patents and innovative designs	Branch modernization	Development and implementation of innovative designs into activities of the enterprise

The conducted PEST analysis shows different impact level of the analyzed factors for the prospects of bioeconomics development in Ukraine. The owners of this business and potential investors should foremost pay attention to the most influential factors. Thus, we have been outlined the changes that take place in the branch under the influence of different important factors and strategic measures to be taken by the enterprises of the given branch.

4. Biofuel power engineering development strategy on the basis of agriculture by Hoshin Kanri method

The development of bioeconomics on the basis of agriculture needs strategic approach. The designed development strategy ensures the readiness of the state and owners of agricultural enterprises to meet future tendencies of biofuel production increase on the basis of agriculture, designs and implementation of scientifically-based technologies of energy-saving crops growing. The absence of development strategy of biofuel power engineering creates problems for trade relations between Ukraine and other countries producing biofuel power. Taking into account already existing experience of the European Union, the question about readiness of Ukraine for biofuel power engineering development and raising its energy independence arises [40].

Excessive concentration on short-term financial results and current problem-solving leads to the lack of financing for long-term projects. "A strategy is a long-term landmark of the activities of an enterprise which directs its efforts at achieving higher results compared to its competitors" [41]. The designed strategy of the development of biofuel power engineering on the basis of agriculture will make more possibilities for implementation of technological innovations and the decrease in number of present obstacles for the development of biofuel-oriented economics. V.Y. Messel-Veselyak stated that the important goal of the strategy of the development of alternative power production in agriculture is the reduction of energy dependence of Ukraine from imported energy carriers and also diversification of consuming directions by means of expanding the use of agricultural products for biofuel production [42].

In order to build biofuel power engineering strategy on the basis of agriculture let us use Hoshin Kanri method (Table 3).

Hoshin Kanri method entails strategic plan design. It is the key element of "six sigma" methodology, applied in strategic management for perfecting production process and product-making with the least deviations from assigned parameters. Hoshin Kanri method is used by leading world companies such as "Motorola", "Toyota", "General Electric" and others. The given method is also known as the policy deployment method [43].

The main document of Hoshin Kanri that contains all strategic, tactical, operational goals and interconnections between them is the X-matrix. The primary advantage of the X-matrix is the ability to display the whole process of strategy design in on A3 format page.

As we see from Table 3 the developed strategy of the development of biofuel power engineering on the basis of agriculture is counted for 3 years and it includes strategic goals, tactical goals, processes and results.

Among primary strategic goals we have separated the following:

1. Perfection of economic and legislative state policy mechanism of the development of bioeconomics.

2. Increase of volumes of foreign and domestic investments attraction.

3. Implementation of innovative biofuel power engineering technologies in production.

4. Raising social responsibility level of businesses and population.

According to the outlined strategic goals we have defined tactical goals (project programs), specificated according to the processes to be performed.

Among tactical goals ensuring realization of the above-mentioned processes are the following:

1. Perfect economic and legislative and organizational-accounting tools that will stimulate the development policy of biofuel power engineering on the basis of agriculture.

2. Ensure new goods development and biofuel production.

3. Ensure agricultural development.

4. Administer biofuel goods quality control.

5. Increase selling rates.

6. Implement training development programs for agricultural management and staff in terms of biofuel power engineering development.

7. Introduce innovative biofuel power engineering technologies to production.

8. Develop social responsibility program.

Table 3 Biofuel power engineering development strategy on the basis of agriculture (according to Hoshin Kanri method)

X-matrix				**Subject: Biofuel power engineering development strategy on the basis of agriculture for 3 years**												
Correlation				Correlation/ input									Dependence			
◙	◙	○	□	To improve economic-legislation and organizational-accounting tools for stimulation policy of biofuel power engineering on the basis of agriculture	◙	◙	◙	◙	□	□	□	○	□				
□	○	□	□	To ensure the development of new goods and biofuel energy production	□	○	○	◙	□	□	○	○	◙				
○	□	○	○	To ensure the development of agriculture	○	○	□	○	○	○	○	□	□				
□	□	○	□	To perform biofuel energy quality control	□	○	□	○	□	□	○	○	□				
□	◙	□	○	To increase sales rates (margin boost, conversions)	□	○	◙	□	□	□	○	○	○				
○	○	○	○	To implement training programs of managers development and agricultural staff in questions of bioeconomics	○	○	○	○	○	○	◙	○	○				
○	□	◙	□	To implement innovative biofuel technologies into production	○	○	□	□	◙	◙	○	○	□				
○	○	○	◙	To design social responsibility program	○	○	○	□	○	○	○	◙	◙				
Perfection of legislation and regulation mechanism of state policy of biofuel power engineering development	The increase of the level of domestic and foreign investments attraction	Implementation of innovative technologies into production	Raising social responsibility level	Strategy (3 years) tactics (projects programs) process **X** results	To develop effective economic and legislation and organizational-accounting tools that will stimulate biofuel power engineering policy development	To conduct sociological questioning of conceptual basics of biofuel power engineering development on the basis of agriculture	To approve investment policy	To develop stimulation program of new goods production and biofuel	To implement modernization program and upgrade materiel and technical support	To approve the program of innovative technologies implementation into biofuel power engineering	To develop training programs for management and agricultural staff	To launch pr-campaign concerning alternative sources use on the basis of agriculture	To stimulate construction and use of waste treatment facilities, low-waste and non-waste technologies development	"Smart" organization			
														Project participant 1	Project participant 2	Project participant 3	Project participant n
1	2	3	4		1	2	3	4	5	6	7	8	9	Correlation marks			
◙	◙	□	□	Ukraine's withdrawal from power dependence and from expensive and non-renewable energy sources										◙ – strong connection, team leader ○–notable connection, one of the key team members □ – weak connection, sporadic team member			
◙	◙	○	◙	The increase of biofuel power engineering share on the basis of agriculture in power production													
○	□	◙	○	The increase of profitability of agricultural enterprises, raising the efficiency of resources consumption													
◙	◙	◙	□	Volume of investments increase, ROI value increase													
◙	○	◙	□	Adherence to commercial quality values													
□	○	◙	○	The increase of professional level of management of agricultural enterprises, raising power awareness culture													
□	○	○	◙	Raising social responsibility level of agricultural enterprises and population													

The realization of the given strategy of biofuel power engineering development on the basis of agriculture will make it possible to obtain the following results:

1. Ukraine's withdrawal from energy dependence from expensive sources and non-renewable energy sources.

2. Share of biofuel power production total power production on the basis of agriculture.

3. Increase of profitability of agricultural enterprises, raising power consuming efficiency.

4. Investments volume increase, ROI value increase.

5. Adherence to commercial quality values.

6. Raising qualifications level of managers and staff of agricultural enterprises, raising organizational culture level.

7. Raising social responsibility level of agricultural enterprises and population.

In order to optimize the implementation of the development strategy we have established correlation links between strategic and tactical goals, tactical goals and processes as well as between strategic goals and results.

Biofuel power engineering today – is an effective strategic step towards the implementation of the blue ocean strategy in agriculture. This will enable existing agricultural enterprises to create brand new uncompetitive (for the time being in Ukraine) alternative energy market and at the same time to increase primary activity efficiency.

In order to implement the designed strategy, we should create "smart" organization within the structure of project participants that will the responsible for certain work cluster. Having specified the participants of the project it will be possible to establish subordination and correlation connections with programs of the projects.

5. Conclusion

Thus on the basis of conducted analysis of biofuel power engineering trends in Ukraine and designed forecast of changes in current situation until 2025 we came to the conclusion that at present state of power engineering development it is necessary to design and implement clear bioeconomics strategy development.

In order to design efficient bioeconomics development strategy in Ukraine we have performed complex strategic PEST analysis of perspectives and problems of this branch development and designed bioeconomics strategy development with the help of Hoshin Kanri method.

The designed strategy of biofuel power engineering on the basis of agriculture will stimulate the development of this branch in Ukraine and agriculture will become an effective cluster of national economics of the country. One of the primary results of the implemented strategy will be withdrawals of Ukraine from energy dependence from expensive foreign and non-renewable energy sources. Among other advantages we can separate: agricultural areas development, diversification of agricultural economics, providing employment, production of new items, modernizing the branch, producing new goods from biofuel, raising social responsibility level of agricultural enterprises, preventing environmental pollution, etc. Resting upon European Union countries' example in the development of biofuel power engineering on the basis of agriculture and realizing the necessity of search for alternative energy sources further biofuel power engineering development should be considered in the context of perspective directions of investments into ensuring implementation of designed development strategy.

The novelty of this research is the creation of a strategy for the development of agriculture-based biofuel production in Ukraine using an innovative approach based on the Hoshin Kanri matrix. The created strategy of bioenergy development in Ukraine outlines the strategic and tactical directions of the industry development, as well as detailed process changes and expected results from the implementation of this strategy. The strategy also defines the correlations between strategic and tactical tasks, processes, and results. This innovative approach to strategic planning makes it possible to implement the planned measures on the principle of "smart" organization.

The designed strategic outline shows which factors of agricultural enterprises operation should be increased and decreased with the purpose of biofuel power engineering direction development. Thus, business entities will be able to build innovative development trajectory according to "blue ocean" strategy.

Acknowledgements

This work was performed under the scientific project of the Ministry of Education and Science in Ukraine "Development of a mechanism to stimulate the effective use of the economic potential of bioeconomic development in Ukraine".

References

[1] E. Elattar, "Environmental economic dispatch with heat optimization in the presence of renewable energy based on modified shuffle frog leaping algorithm", Energy, vol. 171, pp. 256-269, 2019. (Article)

[2] M. Salam, S. Khan, "Transition towards sustainable energy production – A review of the progress for solar energy in Saudi Arabia", Energy Exploration & Exploitation, DOI: 10.1177/0144598717737442, vol. 36, No. 1, pp. 3-27, 2018. (Article)

[3] A. Demirbas, M. Kabli, R. Alamoudi, W. Ahmad, and A. Basahel, "Renewable energy resource facilities in the Kingdom of Saudi Arabia: Prospects, social and political challenges" Energy Sources, Part B: Economics, Planning, and Policy, DOI: 10.1080/15567249.2014.996303 vol. 12, No. 1, pp. 8-16, 2017. (Article)

[4] K. Seetharaman, N. Moorthy, N. Patwa, A. Saravanan,

and Y. Gupta, "Breaking barriers in deployment of renewable energy", Heliyon, DOI: 10.1016/j.heliyon.2019.e01166, vol. 5, No. 1, 2019. (Article)

[5] E. Kabalci, E. Irmak, I. Colak, "Design of an AC-DC-AC converter for wind turbines", International Journal of Energy Research, Wiley Interscience, DOI: 10.1002/er.1770, vol. 36, No. 2, pp. 169-175. (Article)

[6] N. Nethengwe, S. Uhunamure, D. Tinarwo, "Potentials of Biogas as a Source of Renewable Energy: A Case Study of South Africa", International Journal of Renewable Energy Research, vol. 8, No. 2, pp. 1112-1123, June, 2018. (Article)

[7] Y. Wu, F. Zhao, S. Liu, L. Wang, L. Qiu, G. Alexandrov, and V. Jothiprakash, "Bioenergy production and environmental impacts", Geosci Lett. 5, DOI: 10.1186/s40562-018-0114-y, vol. 14, 2018. (Article)

[8] M. Cossel, M. Wagner, J. Lask, E. Magenau, A. Bauerle, V. Cossel, K. Warrach-Sagi, B. Elbersen, I. Staritsky, M. Eupen, Y. Iqbal, N. Jablonowski, S. Happe, A. Fernando, D. Scordia, S. Cosentino, V. Wulfmeyer, I. Lewandowski, and B. Winkler, "Prospects of Bioenergy Cropping Systems for A More Social-Ecologically Sound Bioeconomy", Agronomy, DOI: 10.3390/agronomy9100605, vol. 9, No. 10, 2019. (Article)

[9] N. Scarlat, J. Dallemand, F. Monforti-Ferrario, and V. Nita, "The role of biomass and bioenergy in a future bioeconomy: Policies and facts", Environmental Development, DOI: 10.1016/j.envdev.2015.03.006, vol. 15, pp. 3-345, 2015. (Article)

[10] S. Larsen, N. Bentsen, T. Dalgaard, U. Jorgensen, J. Olesen, and C. Felby, "Possibilities for near-term bioenergy production and GHG-mitigation through sustainable intensification of agriculture and forestry in Denmark", Environmental Research Letters, DOI: 10.1088/1748-9326/aa9001, vol. 12, 2017. (Article)

[11] V. Yakubiv, O. Panukhnyk, S. Shults, Y. Maksymiv, I. Hryhoruk, N. Popadynets, R. Bilyk, Y. Fedotova, and I. Bilyk, "Application of Economic and Legal Instruments at the Stage of Transition to Bioeconomy", AHFE 2019 International Conference on Human Factors in Artificial Intelligence and Social Computing and the AHFE International Conference of Human Factors in Energy, Washington D.C., USA, pp. 656-666, 24-28 July 2019. (Conference Paper)

[12] S. Hoekman, A. Broch, X. Liu, "Environmental implications of higher ethanol production and use in the US: a literature review. Part I-impacts on water, soil, and air quality", Renew Sustain Energy Rev, DOI: 10.1016/j.rser.2017.05.050, vol. 81, pp. 3140-3158, 2018. (Article)

[13] G. Wisz, L. Nykyruy, V. Yakubiv, I. Hryhoruk, and R. Yavorsky, "Impact of Advanced Research on Development of Renewable Energy Policy: Case of Ukraine (Review)", International Journal of Renewable Energy Research, vol. 8, No. 4, pp. 2367-2384, December, 2018. (Article)

[14] V. Yakubiv, I. Boryshkevych, "Strategic analysis of the development of renewable energetics in the world and in Ukraine", Journal of Vasyl Stefanyk Precarpathian National University, vol. 1, No. 1, pp. 18-25, 2018. (Article)

[15] P. Smith, M. Bustamante, H. Ahammad, H. Clark, H. Dong, E. Elsiddig, H. Haber, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N. Ravindranath, C. Rice, C. Abad, A. Romanovskaya, F. Sperling, F. Tubiello, Agriculture, forestry and other land use (AFOLU) Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge. United Kingdom and New York, NY, USA, 2014. (Standards and Reports)

[16] PricewaterhouseCoopers EU Sustainable and optimal use of biomass for energy in the EU beyond 2020, VITO, Utrecht University, TU Vienna, INFRO, Rütter Soceco & PwC, 2017. (Standards and Reports)

[17] D. Thran, R. Schaldach, M. Millinger, V. Wolf, O. Arendt, J. Ponitka, S. Gartner, N. Rettenmaier, K. Hennenberg, and J. Schüngel, "The MILESTONES modeling framework: An integrated analysis of national bioenergy strategies and their global environmental impacts, Environmental Modelling & Software, DOI: 10.1016/j.envsoft.2016.09.005, vol. 86, pp. 14-29, 2016. (Article)

[18] N. Iwaszczuk, M. Szyba, A. Iwaszczuk, and V. Yakubiv "Production of agricultural biogas from waste – an element of socially responsible actions in the food sector", Acta Innovations, No. 33, pp. 52-62. (Article)

[19] W. Reid, M. Ali, C. Field "The future of bioenergy", Global change biology, DOI: 10.1111/gcb.14883, vol. 26, No. 1, pp. 274-286, 2020. (Article)

[20] E. Jones, H. Gong, D. Ionel, "Optimal Combinations of Utility Level Renewable Generators for a Net Zero Energy Microgrid Considering Different Utility Charge Rates", 2019 8th International Conference on Renewable Energy Research and Applications (ICRERA), Brasov, Romania, pp. 1014-1017, 3-6 November 2019. (Conference Paper)

[21] C. Wu, X. Yin, Z. Yuan, Z. Zhou, and X. Zhuang "The development of bioenergy technology in China", Energy, DOI: 10.1016/j.energy.2009.04.006, vol. 35, Issue 11, pp. 4445-4450, 2010. (Article)

[22] L. Rajmohan, R. Chandrasekaran, S. Varjani "Trends and advances in bioenergy production and sustainable solid waste management", Energy & Environment, DOI: 10.1177/0958305X19882415, 2019. (Article)

[23] J. Tock, Ch. Lai, K. Lee, K. Tan, and S. Bhatia "Banana biomass as potential renewable energy resource: A Malaysian case study", Renewable and Sustainable Energy Reviews, DOI: 10.1016/j.rser.2009.10.010, vol. 14, No. 2, pp. 798-805, 2010. (Article)

[24] W. Stafford, G. Lotter, G. Maltitz, and A. Brent "Biofuels technology development in Southern Africa", Development Southern Africa, DOI: 10.1080/0376835X.2018.1481732, vol. 36, No. 2, pp. 155-174, 2019. (Article)

[25] I. Semerci, F. Guler "Pretreatment of Crop Wastes

from Edible Biomass with a Protic Ionic Liquid", International Journal of Renewable Energy Research, vol. 9, No. 1, pp. 17-23, March, 2019. (Article)

[26] Md. Hossain, F. Rahman "Hybrid Solar PV/Biomass Powered Energy Efficient Remote Cellular Base Stations", International Journal of Renewable Energy Research, vol. 10, No. 1, pp. 329-342, March, 2020. (Article)

[27] D. Icaza, D. Borge-Diez, "Potential Sources of Renewable Energy for the Energy Supply in the City of Cuenca-Ecuador with Towards a Smart Grid", 2019 8th International Conference on Renewable Energy Research and Applications (ICRERA), Brasov, Romania, pp. 603-610, 3-6 November 2019. (Conference Paper)

[28] O. Soimu "A SWOT Analysis of Bio-energy Production in Republic of Moldova", Procedia - Social and Behavioral Sciences, DOI: 10.1016/j.sbspro.2014.08.277, vol. 149, pp. 896-900, 2014. (Article)

[29] T. Liu, B. McConkey, Z. Ma, Z. Liu, X. Li, and L. Cheng "Strengths, Weaknessness, Opportunities and Threats Analysis of Bioenergy Production on Marginal Land", Energy Procedia, DOI: 10.1016/j.egypro.2011.03.409, vol. 5, pp. 2378-2386, 2011. (Article)

[30] J. Catron, G. Stainback, P. Dwivedi, and J. Lhotka "Bioenergy development in Kentucky: A SWOT-ANP analysis", Forest Policy and Economics, DOI: 10.1016/j.forpol.2012.12.003, vol. 28, pp. 38-43, 2013. (Article)

[31] M. Garba, M. Tankari, G. Lefebvre, "Methodology for Analyzing of a Grid Weakness and Resiliency Factors – case of Niger National Grid", 2018 7th International Conference on Renewable Energy Research and Applications (ICRERA), Paris, pp. 1259-1265, 14-17 October 2018. (Conference Paper)

[32] A. Rubio, W. Agila, "Sustainable Energy: A Strategic Overview of Fuel Cells", 2019 8th International Conference on Renewable Energy Research and Applications (ICRERA), Brasov, Romania, pp. 239-243, 3-6 November 2019. (Conference Paper)

[33] S. Achinas, J. Horjus, V. Achinas and G. Euverink "A PESTLE Analysis of Biofuels Energy Industry in Europe", Sustainability, DOI: 10.3390/su11215981, vol. 11, No. 21, 2019. (Article)

[34] L. Racz, D. Fozer, T. Nagy, A. Toth, E. Haaz, J. Tarjani, A. Andre, A. Selim, N. Valentinyi, L. Mika, C. Deak, and P. Mizsey, "Extensive comparison of biodiesel production alternatives with life cycle, PESTLE and multi-criteria decision analyses", Clean Technologies and Environmental Policy, DOI: 10.1007/s10098-018-1527-1, vol. 20, No. 9, pp. 2013-2024, 2018. (Article)

[35] X. Zhang, Yu. Li, A. Wang, L. Gao, H. Xu, and X. Ning "The Development Strategies and Technology Roadmap of Bioenergy for a Typical Region: A Case Study in the Beijing-Tianjin-Hebei Region in China", Energies, DOI: 10.3390/en13040844, vol. 13, No. 4, 2020. (Article)

[36] M. Gonzalez-Salazar, M. Venturini, W. Poganietz, M. Finkenrath, T. Kirsten, H. Acevedo, P. Spina, "Development of a technology roadmap for bioenergy exploitation including biofuels, waste-to-energy and power generation & CHP", Applied Energy, DOI: 10.1016/j.apenergy.2016.07.120, vol. 180, pp. 338-352, 2016. (Article)

[37] D. Sunter, B. Murray, M. Lehmann, R. Green, B. Ke, B. Maushund, and D. Kammen, "Two-stage Monte Carlo simulation to forecast levelized cost of electricity for wave energy", 2017 IEEE 6th International Conference on Renewable Energy Research and Applications (ICRERA), San Diego, CA, pp. 638-641, 5-8 November 2017. (Conference Paper)

[38] New energy strategy of Ukraine until 2035: "safety, energy efficiency, competitiveness", Ministry of Energy and Coal Industry of Ukraine, 2017. [Online]. Available: http://mpe.kmu.gov.ua/minugol/doccatalog/document?id=245214948 (Accessed: 26-May-2020)

[39] World Energy Statistics, International Energy Agency, 2019. (Standards and Reports)

[40] L. Tikhonchuk, "State policy of development of agricultural complex in the aspect of bioenergy", Public administration: improvement and development, 2012. [Online]. Available: http://www.dy.nayka.com.ua/?op=1&z=607 (Accessed: 19-Apr-2020)

[41] V. Yakubiv, I. Boryshkevych, R. Yakubiv, "Balanced System of Economic Performances as a Strategy-forming Tool of Development of Agricultural Enterprises", Scientific Papers Series "Management, Economic Engineering in Agriculture and Rural Development", vol. 19. Issue 3. pp. 669-679, 2019. (Article)

[42] Yu. Lupenko, V. Mesel-Veselyak, Development of alternative energy production in agriculture, IAE Scientific and Production Center, 2012, pp. 30-33. (Book)

[43] I. Boryshkevych, "Formulation of a Typical Development Strategy for Agricultural Enterprises (by the Method of Hoshin Kanri)", Journal of Vasyl Stefanyk Precarpathian National University, vol. 6. № 3-4, pp 15-21, 2019. (Article)