UDC 330.322.3:334.716

Elena Linkova
PhD (Economics), Associate Professor,
National Technical University «Kharkiv Polytechnic Institute», Kharkiv, Ukraine
21 Frunze Str., Kharkiv, 61002, Ukraine
Linkova_Yu@mail.ru

Ukraine's industrial enterprises survival in conditions of energy crisis

Abstract
Introduction. Today there exist alternatives to traditional energy sources available on the market. Their effective use depends on the organizational measures taken by industrial enterprises. Therefore, the main problem related to the survival of business entities is the implementation of the energy security strategy of the business.
Purpose of the article is implementation of innovative development of industrial enterprises in the conditions of energy crisis.
Methods. A systematic approach is applied to construct a universal model of industrial enterprises' development strategy; an integrated approach is used regarding the determination of industrial enterprises' cooperation levels in the geographic regions. We have applied the method of analysis to determine the alternatives of new energy sources, whereas the hypothetico-deductive method was used to justify the results from the practical use of the enterprise model development strategy.
Results. Formation of industrial enterprises' subdivisions on realization of the strategy of innovation development will make it possible to form information field for control of innovation process; to effectively finance the innovative activity of enterprises; to increase financial resources intended for conducting the innovation activity of enterprises; to plan innovation development on the basis of the financial possibilities; to ensure mobility of the industrial enterprise in the conditions of innovative changes; to improve the results of financial and economic activity.
Conclusions. The use of a universal model of industrial enterprises' development strategy on the basis of innovations and their social significance will help: to formulate the objectives in the development field, to create a consistent process for the development and adoption of administrative decisions; to define the requirements for implementation of strategic innovation planning; to create economically viable associations of economic entities for the implementation of projects to ensure energy security.
Keywords: Survival Strategy; Energy Crisis; Development of Industrial Enterprise; System Approach; Sources of Energy
JEL Classification: D21; D29; D80; D81; D83; F29; F35; E22; E23; E61; H56; L52; L89; L94; M11; M14; O10; O11; O31; O32; Q20; Q21; Q25; Q42; Q49

Лінькова О. Ю.
кандидат економічних наук, доцент кафедри менеджменту та оподаткування,
Національний технічний університет «Харківський політехнічний інститут», Харків, Україна
Виживання промислових підприємств України за умов енергетичної кризи

Анотація. У статті проаналізовано процес моделювання інноваційного менеджменту для здійснення промисловими підприємствами ефективної діяльності за умов енергетичної кризи в Україні. На основі системного підходу зроблено висновки щодо послідовності заходів для забезпечення енергетичної безпеки промислових підприємств. Формування на промислових підприємствах підрозділів щодо реалізації стратегії інноваційного розвитку дозволить: сформувати інформаційне поле для управління інноваційними процесами; ефективно управляти фінансуванням інноваційної діяльності підприємства; сприяти збільшенню коштів для проведення інноваційної політики; планувати інноваційний розвиток, виходячи з фінансових можливостей; забезпечити мобільність промислового підприємства в умовах інноваційних змін; покращити фінансово-економічні результати діяльності.
Ключові слова: стратегія виживання; енергетична криза; розвиток промислового підприємства; системний підхід; джерела енергії.

Линькова Е. Ю.
кандидат экономических наук, доцент кафедры менеджмента и налогообложения,
Национальный технический университет «Харьковский политехнический институт», Харьков, Украина
Выживание промышленных предприятий Украины в условиях энергетического кризиса

Аннотация. В статье проанализирован процесс моделирования инновационного менеджмента для осуществления промышленными предприятиями эффективной деятельности в условиях энергетического кризиса в Украине. На основе системного подхода сделан вывод о последовательности мероприятий по обеспечению энергетической безопасности промышленных предприятий. Формирование на промышленных предприятиях подразделений по реализации стратегии инновационного развития позволит: сформировать информационное поле для управления инновационными процессами; эффективно управлять финансированием инновационной деятельности предприятия; увеличить финансовые ресурсы для проведения инновационной политики; планировать инновационное развитие исходя из финансовых возможностей; обеспечить мобильность промышленного предприятия в условиях инновационных изменений; улучшить результаты финансово-экономической деятельности.
Ключевые слова: стратегия выживания; энергетический кризис; развитие промышленного предприятия; системный подход; источники энергии.

1. Introduction. The amount of fossil fuels (coal, natural gas and oil) is limited in nature. The dependence of industrial enterprises on fluctuations in energy prices is becoming a more difficult problem. The search for new sources of energy gives a positive result. So, today, the following sources of renewable energy are being explored:

1. Solar energy (solar photovoltaic panels). Advantages: renewable, environmentally friendly, can be recycled into heat

and electrical energy. Disadvantages: dependence of the intensity of solar energy from daily and seasonal rhythm, the need for large areas for the construction of solar power plants, use of toxic substances in the manufacture of photovoltaic cells for helium systems, the problem of their disposal. In Ukraine, the solar power plants (SPP) are: SPP «Danube» with a capacity of 43 MW (as of 2012), 80 acres located near the village of Dalinovka, Odessa region; SPS «Danube» with a capacity of 42,95 MW (as of 2012), 80 acres located near the village of Starokozache, Odessa region, occupies; SPS «Skadovsk» with a capacity of 9.8 MW (as of 2013), 20 acres located near the village of Azure, Kherson region.

2. Wind energy. Wind power leads to an air wheel, this movement is transmitted to the rotor of the electric generator. Advantages: an inexhaustible source of energy; there is no environmental pollution. Disadvantages: non-permanent capacity of the wind, low power air generators, noise, high cost.

3. Geothermal energy (volcanic areas, hot water and steam). Advantages: renewable; independence from time of day and time of year; environmentally friendly; can be recycled into heat and electrical energy. Disadvantages: thermal water is highly mineralized and rich in toxic compounds that prevent discharge to surface water bodies, and this requires re-injection to the aquifer, which leads to higher expenditure; seismologists believe that intervention in the deeper layers of the Earth could trigger earthquakes.

4. Hydrogen energy. The main reserves of hydrogen are in water. Advantages: the emission of the engine that runs on hydrogen (water) is absolutely clean. Disadvantages: difficulty of separation of hydrogen and oxygen (there are two techniques: heating and passing an electric jet through the water). Finding a cheaper way of allocation are chemists' physicists' and biologists' task.

5. Solar energy obtained in space. The outer atmosphere reflects some of the sun's energy. Therefore, there is a need to place a solar power station in space to circle the earth's surface. Advantages: conversion of one form of energy into another is accompanied by release of heat. Its release into space will reduce the risk of negative influence on the atmosphere. Disadvantages: «microwave radiation» affect the Earth's ionosphere and many living organisms; high costs; the need for large areas for placement of antennas.

6. Fusion energy from helium. Reserves of helium (from 3 to 10 million tons) were found in the surface layers of the lunar soil. This isotope is very rare on Earth and is produced synthetically, whereas 1t of lunar soil contains 0.01gr. of helium 3. It is easier to obtain fusion energy with this isotope than with any other, e.g. uranium. A few pounds of helium 3 will satisfy a year's need for of all humanity. Modern spacecraft can reach the moon during the day and go back with 20 tons of helium 3. Advantages: much smaller degradation of structural materials of the reactor due to the decrease of radioactivity; additional generation of energy; inactive starting materials that does not require additional security measures; radioactivity release during depressurization of the reactor is equal to zero. Disadvantages: significantly higher threshold temperature of the reaction; difficulty of mining on the moon and export to Earth is expensive [9].

Consequently, there is an alternative to traditional energy sources. However, their use requires a certain innovative algorithm of action for the implementation of the energy security strategy relevant to the management of industrial enterprises.

2. Brief Literature Review

The issues related to the present article have been studied by the following domestic and foreign scientists: Y. Samoilenko, N. Hrihorchuk (2013); J. V. Prodan, B. S. Stohnii (2008), A. J. Senkowski (2012), P. Drucker (2010, 2012), R. R. Blake, J. S. Mouton. (2013), Karl Ludwig von Bertalanffy (1956).

The research of energy security can be divided into three parts: the first one deals with the analysis of the stability of supply, prices, conflicts over energy transit (which contains a lot of political questions); the second one is the forecast for economic growth, energy consumption, diversification of energy sources (optimization of costs in the world); the third one is the analysis of global climate change. [1-14].

But it leaves open the question of solving the problems of energy security of industrial enterprises (providing mankind with energy resources for economic and social development taking into account environmental sustainability).

3. Purpose

The article aims at analyzing the implementation of innovative development of industrial enterprises in conditions of energy crisis, determining the responsibilities of subdivisions involved in the management and innovative development of industrial enterprises, defining priorities for innovative development of industrial enterprises in the conditions of the energy crisis in Ukraine.

4. Results

The National Commission, which Performs State Regulation in the Energy and Utilities on August 27, 2015 implemented the Decision No 2229 About the Marginal Level of Natural Gas Prices Settlement for the Industrial Enterprises, Households and Other Economic Subjects in order to raise gas prices for Ukrainian industrial enterprises to 6,600 UAH per one thousand cubic meters. Such a price is unacceptable for the majority of industrial enterprises in Ukraine.

It raises the issue of systemic reform of national industrial enterprises. There is a need for a fundamental change in the production technology due to the expansion of markets and activities. The model of innovative development strategy of industrial enterprises (management decision) determines the sequence of possible states, which characterize the way of achieving the development goals. The system approach will allow us to determine actual ways and directions of the industrial enterprises' development model realization. Such an approach is based at the understanding and taking into account the key features of the systems, namely:

- The system consists of elements and interactions between them.
- The system may be less than the sum of its parts, if some of them belong to the other system.
- When an element belongs to several systems, its state in one system may change when the state changes on the other system.
- The state of the system is a function of the states of its elements, their interaction among themselves and with the environment.
- Any system that exchanges with the environment is an open system.
- The most important form of exchange between system and environment is obtaining inputs and outputs.
- The system outputs can be positive-valued goods manufactured or negative side effects.
- Forces in the external environment (external constraints) that define the system, its inputs, methods of operation, methods of evaluation outputs.
- Steady state determines a significant part of internal system constraints.
- An open system can be artificially and conventionally closed for purposes of analysis.

The level and composition of the studied system are chosen by a specialist on the analysis of systems in accordance with the set problem [8, 138].

A system approach to the modeling of innovative development of industrial enterprises in conditions of energy crisis includes such elements:

1) Analysis of the control object (the study of production processes).

2) Establishment of management subjects and their relationships evaluating.

3) Non-hierarchic organizational principle implementation, which allows to consider the innovative system of industrial enterprise's management as an advanced and open.

4) Analysis of environmental factors from the point of view of their influence on the possibilities and the limits of development.

5) Identification of the steady states of the system, which imposes restrictions on the level and the rate of permissible variation as well as provides an opportunity to identify stability factors that is the basis for further innovation.

6) Definition of the whole range of needs and functions of the industrial enterprise's management system in addition to innovative development.

7) Systematization of the intermediate results of the industrial enterprise's activity (social values).

8) Software development updates based at economic information of all the elements of the industrial enterprise.

The universal model of development strategy of the industrial enterprises on the basis of innovations and their social significance contains three main blocks:

1. The purpose of the industrial enterprises' development:
- The growth of investment in innovation.
- Technological update providing.
- The constancy of energy security.
- The level of personnel training raise.
- Conditions of labor protection improving.

2. The sequence of innovation and managerial decision-making process development:
- Assessment the relevance of the objectives for each industrial facility.
- Assessment the limitations for the development of internal and external factors.
- Development of alternatives to achieve the selected goal.
- Evaluation and selection of effective alternatives.
- Realization of the best alternatives.
- Evaluation of the results of achieving the goal.

3. Requirements for strategic innovation plans of the enterprise:
- High social value of innovations and state compensation.
- Professional development of staff.
- Economic efficiency of strategic plans.
- Strengthening of control over observance of intellectual property rights.
- Energy security of the industrial enterprise is the growth of the social importance of this problem and the effectiveness of its decision – from the fruitfulness of cooperation of industrial enterprises.

The interaction of industrial enterprises is complex and difficult to understand identify the main levels:
- The increase of the investment potential of the region.
- Establishing social balance.
- The office of energy security.
- Economic efficiency.

Proposals for the implementation of a universal development model will include the project for the construction of solar power plants in the industrial regions of the city of Kharkiv.

For example, Ordjonikidzovskii district of the city of Kharkiv corresponds to the initial conditions of cooperation of industrial enterprises:
- the number (6 engineering companies: PJSC (public joint stock company) «Kharkiv tractor plant», SE (state enterprise) plant «Electrotyazhmash», PJSC «KhEMZ-IPEC», PJSC «Kharkiv machines plant», PJSC «Kharkiv bearing plant», LLC (limited liability Company) «Ukrainian casting company»);
- profitability (Ordjonikidzovsky district is one of the leaders in terms of sales industrial production is 18.7 % in the citywide total);
- the area (33,4 sq. km, or 11 % of the total area of the city, the area of green plantings is 980 acres);
- industrial structure of the district: food industry – 7 companies; mechanical – 6 plants; construction of 12 companies; printing and other types of activity – 5 enterprises [15].

There is a certain project limitation: according to the accepted classification, the average annual total solar radiation in the city of Kharkiv refers to the fourth zone, which is 1000 KWh (sq. m / year) [16]. The same indicators characterize are Central European countries, which have successful experience of using solar energy.

In Ukraine, there are companies that successfully implement these projects regarding the construction and maintenance of solar power plants, namely: «Centre Climate Ukraine» Ltd; «Renewable Energy Solution – Beyond Expectations» Group; «Active Solar» Company; «Technonovator» Production and Construction Company.

Solar photovoltaic panels can be placed on most of the roofs of industrial buildings in Ordjonikidzovskii district of the city of Kharkiv.

The initial budget for the implementation of the energy project consists of monthly net income of each of the companies of participants, the size of which will determine the participation in the income from future receipts of electricity.

A solar cell with an efficiency of 15 % (1 kg of silicon) for 30 years can produce 300 MW per year, of electricity (similar to that required 75 tons of oil).

The use of a universal model of development strategy of industrial enterprises on the basis of innovations and their social significance enables us to formulate development goals, to establish a consistent process for the development and adoption of administrative decisions, formulate requirements to the strategic plans of the enterprise innovation activity. Practical implementation of innovative projects on alternative energy sources has certain stages:

a) creation of limited partnerships involving representatives of industrial enterprises of certain territorial centers, the heads of the existing energy companies, foreign consultants having experience of implementation of alternative energy sources or associations of industrial enterprises to implement energy projects (PJSC «Kharkiv tractor plant», SE plant «Electrotyazhmash», PJSC «KhEMZ-IPEC», PJSC «Kharkiv machines plant», PJSC «Kharkiv bearing plant», «Ukrainian casting company» Ltd);

b) securing long-term contracts with the energy company East RES (Regional Electric Networks) for Ordjonikidzovskii district;

c) development of long-term plans for capacity growth for new energy facilities (initial project to have objective economic rationale for the merging parties for the implementation of new energy projects, and planning for the next years are already testing different technical capabilities using your own technology);

d) meeting energy needs of certain regions at the expense of alternative sources of energy and adjustment of programs to support entrepreneurs, the implementation of energy projects (inclusion of heads of Kharkiv region to coordinate energy projects in the region).

So, a systematic approach to the management of industrial enterprise in the conditions of energy crisis through innovation allows drawing conclusions on possible actions in this field:

The solutions for the industrial enterprise in the field of power pack contain many different approaches to the problems of energy security management of an industrial enterprise. It requires cooperation at all levels – from local to international. The goals of energy security are not universal.

In order to achieve efficient results in the field of energy security, it is required that the state keeps the main objective: to improve energy efficiency and to help economic agents to make right decisions.

The priority areas of innovative development of industrial enterprises in Ukraine can be: organizational change of cooperation mechanisms between industrial enterprises of individual regions (for example, for construction of solar power plants); upgrading of energy-efficient technologies of production; provision of a better service to consumers; development of effective communication channels; cooperation of different sectors; sourcing of better resources.

Mechanisms of interaction of industrial enterprises of individual regions are the main reserve of overcoming the energy problems. But any organizational education requires initial government approval in the form of state support. The Union of Kharkiv Region Entrepreneurs will make it possible to accumulate the necessary amount of funds needed for technological renewal. The practice of using solar power plants in Germany indicates a payback period of 10 years with a margin of 10%, which requires the creation of certain industrial complexes. For example, the city of Kharkiv has a strong potential of machine-building enterprises (over 60). In business, there is a possibility of realization of projects of significant cost and payback pe-

riod, which may also contribute to the implementation of social problems of the region.

The principal obligations of subdivisions engaged in realization of strategy of development are: construction of a database on partner companies and organization among industrial enterprises; a systematic analysis of progress of technological processes and their improvement; participation in curriculum development techniques; practical assistance to innovators; the introduction of advanced achievements of science; experimental research works.

The basic skills of innovative staff development division of the company are: the choice of directions of innovative activities; development of a selection system and rewards for innovative ideas; calculation of the costs and effectiveness of innovative projects; conclusion of contracts with research institutions; management of titles of protection for inventions.

The main purpose of the head of the innovation management is the effective use of scientific, scientific-technical and intellectual potential to obtain a new product, method of its production and meet the needs of the society of competitive goods.

The essence of the innovation strategy of the industrial enterprise is in its active influence on the market, and changing internal factors in accordance with modern trends. In the current economic conditions (globalization, the exhaustion of the possibilities of extensive sources of competition, a clear segmentation of consumer markets and their individualization, limiting price competition, a large number of high-performance manufacturers) implementation of the innovation strategy of the industrial enterprise is a necessity for its survival.

The main features of the growth of domestic industrial enterprises are as follows: anticipating market changes; the search for new market niches; the offer of innovative products; the provision of existing products to add value. Effective implementation of the above possibilities in Ukraine includes: the availability of scientific and technical infrastructure; the relevant policies of the state.

The transition of domestic industrial enterprises to innovative strategy requires significant changes in the factors of the internal environment: corporate culture; the creation or use of existing research structures in the field of marketing and science; the organization of the process of technology development and adaptation; training of personnel.

To secure effective activity of industrial enterprises in conditions of energy crisis in Ukraine, it is necessary to implement a sequence of measures to ensure their energy security. The formation of the industrial enterprises of the units to implement the strategy of innovative development will allow: to form the information field of management of innovation processes; effectively manage the financing of innovative activity of the enterprise and the region; to increase funding for implementation of innovation policy; to plan innovative developments based on financial capacity; to ensure the mobility of the industrial enterprise's innovative changes; to improve financial and economic performance.

5. Conclusions.

Implementation of a universal model of development strategy of industrial enterprises on the basis of innovations and their social significance enables us to formulate development goals, to establish a consistent process for the development and adoption of administrative decisions, to formulate requirements to the strategic plans of the enterprise innovation activity.

Directions for further research: testing the model of strategy of innovative development of industrial enterprises under the condition of energy crisis in the country.

References:

1. Johnson, G., Castes, F., & Rosenzweig D. (1971). *Systems and leadership.* Moscow: Soviet radio (in Russ.).
2. Optner, S. (1969). *System analysis to solve business and industrial problems.* Moscow: Soviet radio (in Russ.).
3. Drucker, P. (2010). *Management, focused on results.* Saint Petersburg: Technologist. School of business (in Russ.).
4. Blake, G., & Mouton D. (2013). *Scientific methods of management.* Kiev: High school (in Russ.).
5. *China-Japan: problems of energy security in northeast Asia (2013).* Retrieved from http://rud.exdat.com/docs/index-808317.html?page=2
6. Ustimenko, A. (2011). Davos 2011: Optimism, but cautious. *Kazenergy. 1*(43), 17-18 (in Russ.).
7. Zerkalo, D. (2012). *Energy security.* Kyiv: Osnova (in Russ.).
8. Ashby, W. (2005). *Introduction to Cybernetics.* Moscow: Komkniga (in Russ.).
9. *Alternative Energy Sources.* Retrieved from http://electrik.info/main/news/614-alternativnye-istochniki-energii.html (in Russ.)
10. Drucker, P. (2012). *Management. Challenges of the 20th century*. Moscow: Mann, Ivanov and Ferber (in Russ.).
11. Bertalanffy, L. von. (1956). *General System Theory.* General Systems. Vol. I.
12. Samoilenko, Yu. (2013) Economic security of Ukraine: legal aspect. *Viche (Viche), Journal of the Verkhovna Rada of Ukraine, No. 17*. Retrieved from http://www.viche.info /journal/3838/ (in Ukr.)
13. Prodan ,U. (2008). *Energy security of Ukraine: assessment and direction of provision.* Kyiv (in Ukr.).
14. Senkowski, A. (2012). *Threats to energy security of Ukraine in the conditions of increased competition at the global and regional markets for energy resources.* Analytical report. Kyiv. Retrieved from http://www.niss.gov.ua/content/articles/files/Energo-807fc.pdf (in Ukr.)
15. *Kharkov. Industrial potential (2014).* Retrieved from http://www.invest.kharkov.ua/section/57.html (in Russ.)
16. Solovey, D. (2015). *Usage of solar energy. Does it actual for Ukraine?* Retrieved from http://alterair.com.ua/services/engineering-solutions/alt_energy/74.html (in Russ.)

Received 18.05.2015

References (in language original)

1. Джонсон Р., Каст Ф., Розенцвейг Д. Системы и руководство / Р. Джонсон, Ф. Каст, Д. Розенцвейг – М. : Сов. радио, 1971. – 647 с.
2. Оптнер С. Л. Системный анализ для решения деловых и промышленных проблем / С. Л. Оптнер – М. : Сов. радио, 1969. – 216 с.
3. Дракер П. Ф. Управление, нацеленное на результат / П. Ф. Дракер. – СПб. : Технолог. Школа бизнеса, 2010. – 332 с.
4. Блэйк Р. Р., Мутон Д. С. Научные методы управления / Р. Р., Блэйк, Д. С. Мутон. – Киев : Высшая школа, 2013. – 274 с.
5. Китай-Япония: проблемы энергетической безопасности в регионе Северо-Восточная Азия / [Электронный ресурс]. – Режим доступа : http://rud.exdat.com/docs/index-808317.html?page=2
6. Устименко А. Давос – 2011 : Оптимизм, но осторожный // Kazenergy. – 2011. – № 1(43). – С. 17–18.
7. Зеркалов Д. В. Энергетическая безопасность / Д. В. Зеркалов : Монография. – К. : Основа, 2012. – 920 с.
8. Эшби У. Р. Введение в кібернетику / У. Р. Эшби: пер. с англ. – М. : КомКнига, 2005. – 432 с.
9. Альтернативные источники энергии / [Электронный ресурс]. – Режим доступа : http://electrik.info/main/news/614-alternativnye-istochniki-energii.html
10. Дракер П. Ф. Менеджмент. Вызовы XXI века. / П. Ф. Дракер. – М. : Манн, Иванов и Фербер, 2012. – 256 с.
11. Bertalanffy L. von. General System Theory. / L. von. Bertalanffy // General Systems. 1956. Vol. I.
12. Самойленко Ю. Економічна безпека України: правовий аспект // Віче, журнал Верховної Ради України / Ю. Самойленко, М. Григорчук. – 2013. – № 17 / Електронний ресурс – Режим доступу : http://www.viche.info/journal/3838/
13. Продан Ю. В. Енергетична безпека України: оцінка та напрямки забезпечення / Ю. В. Продан, Б.С. Стогній. – Київ : 2008. – 400 с.
14. Сменковський А. Ю. Загрози енергетичній безпеці України в умовах посилення конкуренції на глобальних та регіональних ринках енергетичних ресурсів / А. Ю. Сменковський // Аналітична доповідь. – Київ, 2012 / [Електронний ресурс] – Режим доступу : http://www.niss.gov.ua/content/articles/files/Energo-807fc.pdf
15. Харьков. Промышленный потенциал / [Электронный ресурс]. – Режим доступа : http://www.invest.kharkov.ua/section/57.html
16. Соловей Д. Использование энергии солнца – актуально для Украины? / Д. Соловей. – [Электронный ресурс]. – Режим доступа : http://alterair.com.ua/services/engineering-solutions/alt_energy/74.html

Стаття надійшла до редакції 18.05.2015