LOOK ACADEMIC PUBLISHERS
OPEN ACCESS

IEJME — MATHEMATICS EDUCATION
2016, VOL. 11, NO. 4, 933-945
Article number: mathedu.2016.086

State Evaluation and Priorities Identification of Government Support for Electric Power Industry Development in Ukraine

Svitlana I. Vikhlyaeva[a], Li Chao[a], Nataliya V. Vikhlyaeva[a],

[a]National Technical University "Kharkiv Politechnic Institute", UKRAINE.

ABSTRACT

The rationale involves the fact that electric power industry is able to decrease dependence of Ukraine from foreign oil and gas importing partners; in its turn it will strengthen the economy and will intensify the reputation of the State in the world. Objective of the Study: The objective of the study involves studying of state evaluation and priorities identification of government support for electric power industry development in Ukraine. Methods of the Study: The principal method of this problem study is modeling and applying scenario approach as the method for strategic planning the government support instrument for electric power industry development. Results of the Study: The article involves expert evaluation analysis of current state and priorities of applying government support instruments for stable development of electric power industry in Ukraine. Practical Significance: The scenarios of applying government support instruments for stable development of electric power industry in Ukraine.

KEYWORDS
Electric power industry; government support; expert evaluation; government support instrument; stable development of electric power industry

ARTICLE HISTORY
Received 16 March 2016
Revised 10 April 2016
Accepted 22 May2016

Introduction

Ukraine is classified among the countries partly provided with conventional types of natural energy and has Central European level of energy dependence. At the present moment the power supply and appliance state in Ukraine is characterized with the fact that native economy consumes much more natural energy per the unit of GDP generated; has almost twice bigger part of natural gas in the structure of own energy consumption than the EU countries, the USA and other countries (41 % in Ukraine compared to 21% in the world, 22% in the EU and 24% in the USA); it depends on terms of gas supply from the CIS countries.

CORRESPONDENCE Svitlana I. Vikhlyaeva ✉ vikhlyaeva@ukr.net

Ukrainian nuclear power plants (NPP) generate 45-50% of the electric power consumed in the country. The potential of the country to create energy capacities at nuclear plants allow to come to the conclusion that within the nearest years nuclear plants will remain the base of energy power industry in Ukraine. Energy strategy of Ukraine for the period up to 2030 provides increase in electric power generation in the country up to 420.1 billiard kW/g. Provided that the part of electric power generation at NPP in 2030 shall make 52% of total amount of electric power generation in Ukraine (Filyak, 2013).

The nuclear energy development in Ukraine is an important element for ensuring energy safety of the country. The opportunities for nuclear energy development are tightly associated with the problems of ecology, nuclear and radiological security. Distinctive advantage of nuclear energy is its ecological security compared to thermal power (Leonova, 2013). Obvious advantages of nuclear energy, increasing prices for oil and gas, implementation of the Kyoto Protocol, as the method of controlling global climate changes in the result of not controlled greenhouse gas emissions, led to advanced end of so called gas pause and acceleration of nuclear power development (Fedorchenko, 2013).

But modern power industry has significant challenges (Mel'tyukhova, 2010):

- safety of radioactive wastes disposal for decades and hundreds years in large quantities raises doubts because of reliability of such long-term physical and geological forecasts;
- there exists an emergency in creation nuclear fuel strategic reserves for ensuring Ukrainian NPP operation and solving the matter of spent nuclear fuel strategy;
- significant problems appear due to undercapacity of electric power supply lines for NPPs' power generation (Rivnens'ka, Khmel'nytska, Zaporiz'ka);
- State budget money, allocated to increase energy efficiency, is used rather ineffective.

Due to this fact, the development of the following programs is provided to increase NPPs' world efficiency: "Programs for Development of Long-Distance and International Electrical Networks with voltage 220-750 kW", "Programs for Integration of Ukrainian Energy System in European (Integration in UCTE):, "Programs for Development of Export Potential of Ukrainian Fuel and Energy Complex", "Adaptation of Energy Legislation of Ukraine to the Legislation of the European Union", and "Program for Research and Development Support", etc. (Zerkalov, 2012).

Energy consumption demand growth with every year. Ukraine is classified among the countries with high energy consumption, that is why there exists the need in rational use and improvement of delivery energy state to the consumer, and that is why Ukraine has to make reforms in the legislation on electric power industry in accordance with European standards and to remove all problems concerning technical state of NPPs.

Electric power industry is able to decrease dependence of our country from foreign oil and gas importing partners; in its turn it will strengthen the economy and will intensify reputation of the State in the world. It determines the rationale of this work.

Materials and Methods

The following methods were used within the study: theoretical (analysis, synthesis, specification, generalization, analogue method, modeling, scenario approach); diagnostic (polling, interview, testing, task method, expert evaluation); empiric; experimental (summative, formative and control experiments); methods of mathematical statistics and graphical recording.

Research and experimental base of the study includes 50 leading enterprises in the electric power sector of Ukraine.

The problem has been studied in three stages:

At the first stage the theoretical analysis of existing methodological approaches in science literature and thesis works on the problem was performed, and also theories and methods for scenario approach and expert evaluations; problem, objective and methods of study were determined, the plan for experimental study was prepared.

At the second stage of scenario approach appliance, as the method for strategic planning concerning the government support instrument for electric power industry development was justified; research and experimental work was performed, conclusions obtained during experimental work were analyzed, checked and specified.

At the third stage experimental work was completed, theoretical and practical conclusions were specified, obtained results were generalized and organized.

Results

The problem solution for ensuring stable development of electric power industry provides creation of development plan system which from one hand will detail effect factors on the end result, and therefore, to determine rationale directions of regulating effect, and from another - allow evaluating the efficiency of instruments involved and governmental support arrangements performed.

In reality such plans are the reference point for development of economic system of electric power sector creating in general the model, the realization of which shall provide the goals achievement of stable development of the country's electric power industry. It means that every economic decision, taken by State administrative bodies at all its levels, shall correspond to the goals of sector stable development. Potentially achieved measures and opportunities for effect on the character of the development of social-ecological-economical system of electric power sector determine the directions and tempo of indicators change, and stability limits of the sector development (Leonova, 2013).

One of the popular methods for preparing development plans at the sector level involves the scenario approach that some authors oppose to other approaches for planning, namely program-purpose approach that in this work is determined as the most appropriate for realization of methodological method of achievement purposes of stable development of electric power industry. At the same time the author does not support the opposition of scenario and program-purpose approach considering that they can be used at the sector level completing each other in case of using scenario approach as the method for creation variants, strategic goals and priorities of stable development of electric power sector which further shall be implemented based on program-purpose approach.

It means, that scenario approach in the methodology of planning development of the sector and its government support is considered as more prescind general form of structuring and organization of data that determines key positions, priorities, purposes taking into account very complicated system of factors of external and internal influence ob stable development of electric power industry. And id this influence can vary in certain individually determined limits, at is appropriate to use these limits for creation of certain scenario of the sector development. Filling of determined positions with certain directions, instruments, cash flows, measures shall be performed further using program-purpose approach. Or for every scenario or for the scenario chosen as the most appropriate for usage based on strategic analysis of all variants of development (Puchkov, 2014).

Scenario approach is acceptable during forming priorities of the sector development, because it better than other approaches shows changing character of social-ecological and economical transformations in economics in general and in electric power industry in particular. There exists strategic level of scenario development that describes important problems of the sector development and operative scenario for the development of which, for example, the method of mathematic modeling of Monte-Carlo is used in world practice. This work provides focusing on strategic level of scenario development of government support instrument applying for electric power industry development. Mentioned scenarios shall show the variety of meanings concerning the development of scenario planning object, government support instrument for electric power industry development.

The scenario approach, as the strategic planning instrument, is legal regarding use of government support instrument for electric power industry development for the following reasons (Figure 1).

Therefore, the scenario approach is compared with creation of the one possible (the only right) perspective solution of the problem for electric power sector development and it is being the method for solution items on perspective planning of government support instrument applying for electric energy industry development in conceptual projection. The mentioned approach is appropriate in terms of high indefiniteness of electric energy industry development, where traditional planning methods are wrong in the result of differences in initial data evaluation due to effect of personal factor on forecast results.

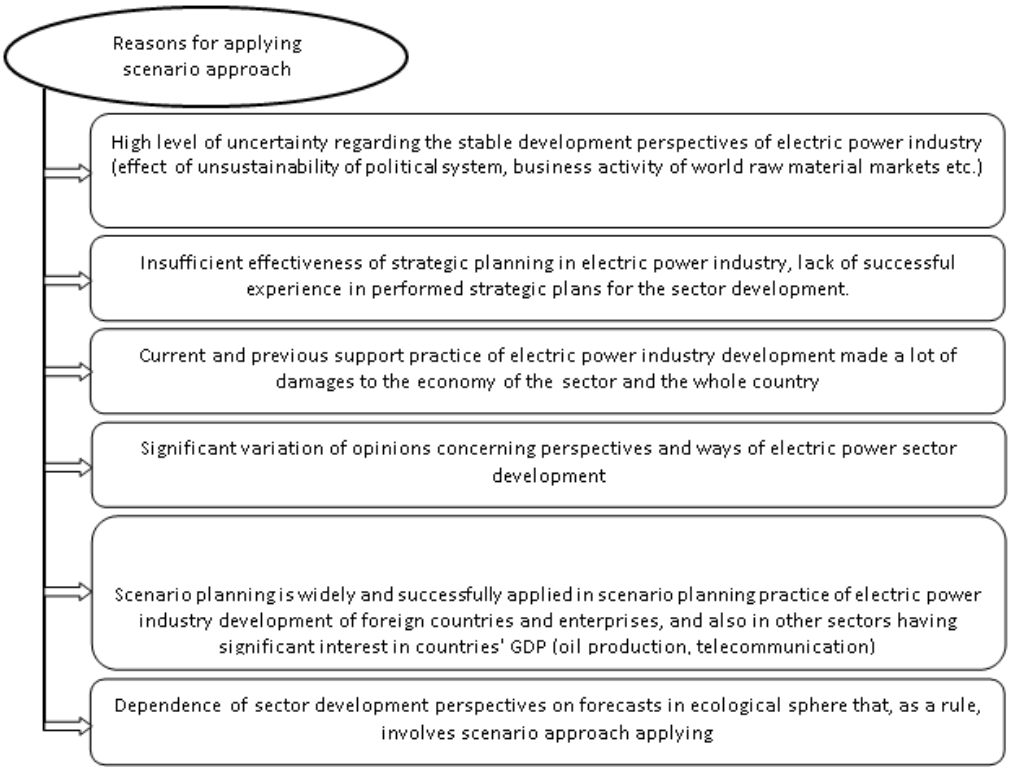

Figure1. Instrument of government support of development electric energy industry

In general, the scenario of government support instrument applying for electric power industry development is not just a range of isolated tendencies, but a range of multi-dimensional models which has interconnection with economic, social, ecological and political situation in country and in the world, technical and technological level of the sector and innovation dynamics.

Appliance of the scenario approach provided performance of the following work stages:

– determination of base strategy for sector stable development according to life cycle stage corresponding to the Ukrainian electric power industry;

– applying government support instruments of stable development for electric power industry in Ukraine;

– preparing the scenarios of government support instruments applying for stable development of electric power industry in Ukraine.

The author considers it is appropriate to determine base strategy for sector stable development in accordance with life cycle stage corresponding to the Ukrainian electric power industry, while preparing the development scenario. Based on the current state analysis, competitive ability and potential development of Ukrainian electric power industry, carried out in the previous sections of this thesis work, life cycle stage, as the sector of growing, shall be determined (Table 1). At this stage Ukrainian electric power industry can be positioned as the industry with middle level of development taking into account that existing (built mainly during the USSR period) infrastructure of the sector and energy production facilities give opportunity to satisfy needs of the population

and enterprises of the country in electric power and even to export electric power in some way.

Table1. Selection of Strategy for Sector Stable Development (with regard to sector life cycle stage and its development level)

Life Cycle Stage	*Development Level of the Sector*	*Type of Strategy*
Growth	Low development level (doldrums)	Strategy of transference and the principles of stable development
	Middle development level	Strategy of expanding stable development instruments ensuring
	Higher than middle level, high	Strategy of economics opening level increasing of the sector enterprises
Stabilization	High development level	Strategy of vertical and horizontal integration
		Strategy of expanding production potential
Disruption	Middle development level	Divestiture strategy
	Lower than middle level	Strategy of restructuring
Crisis, depression	Low development level	Strategy of supporting the development of sector's enterprises and renovation of it's stability
		Strategy of "bankruptcy"

Current stage and correspondent development level of the sector show the need in applying strategy of "expanding instruments for stable development ensuring". In the result of potential danger for negative internal and external environment factors activation due to insufficient competitive ability of economic entities for economic growth support in modern conditions, recession (prices for raw materials, etc.) and integration course of Ukrainian economics with European one, it is appropriate to use strategy of increasing economics opening level of sector's enterprises specific for higher and middle development level of the supplementary sector (Fedorchenko, 2014).

The main tasks of technical re-equipment and electric power industry reconstruction within the limit of realization strategy of stable development involve increasing of economic feasibility and reliable operation of electric power plants, decreasing the possibility of accident situations, increasing ecological safety of the energy system. The main directions of technical policy are the following:

- technical re-equipment and reconstruction of moral and physically worn equipment using devices and materials corresponding to modern technical requirements;
- equipment modernization directed at the use of increasing economic feasibility and capacity of operated equipment reserves;
- increasing effectiveness and decreasing production costs;
- ensuring economic feasibility and reliance of equipment operation;
- decreasing production negative effect on environment.

Specified measures need government support, namely, creation of conditions for development or directly financing, creation of institution environment favorable for implementation progressive organizational and technological

solutions, realization of favorable tax policy and reasonable state control (Filyak, 2013).

During reasoning the scenarios for government support instruments applying for stable development of Ukrainian electric power industry, the author proposes to focus from one side on the need to solve the problems specific to stable development (ecological. economic and social), in particular, which focus on:

- satisfying public needs in electric power;
- solving ecological problems;
- ensuring economic efficiency.

From another side it is needed to discuss the scenarios for solving specified problems and satisfying the needs, the author thinks that such scenarios include the methods of effect on the development in the directions:

- activation of innovation activity;
- activation of state financing;
- activation of long-term indirect support instrument.

In order to specify current state of government support instrument applying for stable development of Ukrainian electric power industry, the author proposed to apply the method of expert evaluation, which sampling and authenticity is reasoned by the probability evaluation system in small samplings with definition of possible limits of mistake in accordance with Student test. The results of this evaluation will serve as initial base for reasoning selection order of government support instrument based on denominated effect of one or another instrument for the current moment or the needs of its development.

The following actions were performed for expert evaluation:

1) preparing study scheme;

2) organization of obtaining information on government support instrument processes for electric power industry development (work with statistical data, review of press data, analytical information, performing interviews, polls);

3) data summarizing and grouping;

4) formation of study conclusions following the results.

The current state evaluation of government support instrument applying for stable development of electric power industry in Ukraine shall be performed based on respondent polling, namely leading top and middle specialists and managers of electric power sector.

Taking into account the need in ensuring maximum study representativeness and completeness of showing adequate state of enterprises' cost control system, it can be reached only be the methods of involving in expert study the respondents possessing information on the sector state control system to characterize it; involving in the study the amount of respondents enough for ensuring appropriate level of representativeness; ensuring required formal study conditions (understanding of polling procedure, formal apparatus for justifying the study representativeness) (Naraevs'kyi, 2015).

For this study 50 respondents could be involved. For the specified amount of respondents it is appropriate to apply mathematical apparatus of small not repeated sampling during evaluation the study results where the value of main dispersion in calculations is not discussed. In this case it is appropriate to apply

Student criteria as the representativeness criteria. The target of the study quality specific for economic studies is the range of possibility (possible limits of sampling mistake) of the study at the level not more than +/- 10-15%, it means with coefficient more than 0.85. It is possible to achieve the possibility at level of 0.865 involving more than 20 (in this case 50) respondents with trust number t=1.5.

The author performed the polling of justified sampling of 50 managers and leading specialist of electric power industry sector in order to evaluate the current state of government support instrument applying for stable development of electric power industry in Ukraine. The polling provided the evaluation of characteristics of applied instrument by five-point system using progressive method.

The results of expert evaluation analysis of the current state of government support instrument applying for stable development of electric power industry in Ukraine make it possible to make statement that the study was performed to the highest standards and the evaluation of the respondents' opinions regarding the subject of the study can be used for forming statistical conclusion. Regarding 50-unit sampling with 1.5 trust coefficient one can say that the evaluation of the current state and priorities of applying stable development for electric power industry in Ukraine can be performed with the possibility of 86.5%, that is rather high accuracy and representativeness study index during study of macro-level economic problems.

Average evaluations by the characteristic groups are shown graphically on Figure 2.

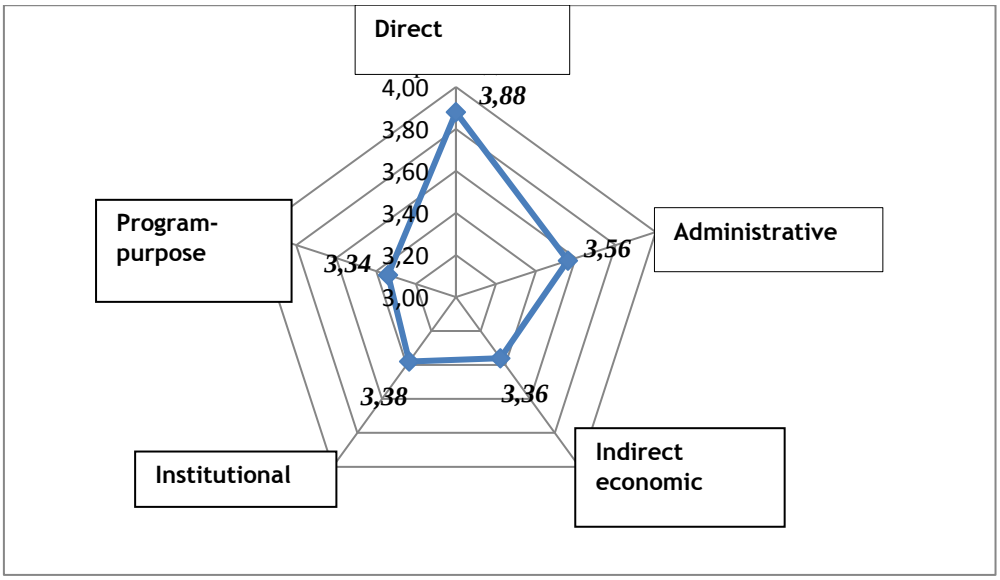

Figure 2. Average Evaluation of Current State of Government Support Instruments Applying for Stable Development of Electric Power Industry in Ukraine

The evaluation results show that at the current moment one can clearly see the bigger activity of the State in applying economic instruments of direct action and administrative instruments, instrument of direct action. The less activity is observed concerning the development support instruments which effect indirectly

on the development, have more late results of its applying, that means, they solve the current problems: groups of economic, institutional and program-purpose instruments.

Figure 3 shows the results of priorities evaluation in government support instruments applying for stable development of electric power industry in Ukraine.

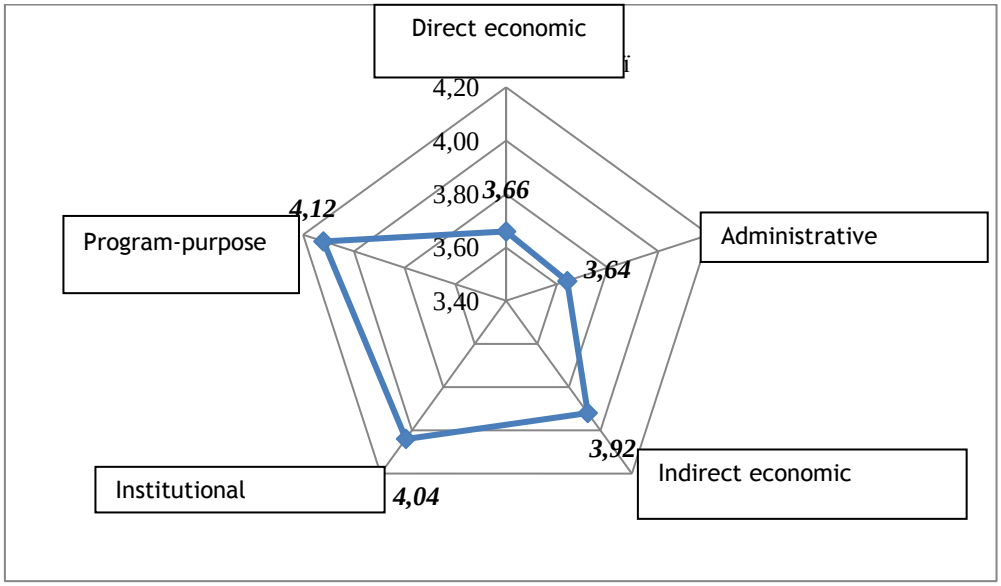

Figure 3. Average Evaluations in Government Support Instruments Applying for Stable Development of Electric Power Industry in Ukraine

The evaluation results showed that the majority of respondents consider that the background for sector stable development involves applying not-direct instruments (in case of keeping required activity on not-direct instruments at appropriate level). First, it is recommended to apply program-purpose instruments (point 4.12, middle expected development level), and institution instruments (point 4.12, middle expected development level), level close to the middle development (3.92) is expected from the State regarding economic not-direct instruments. Therefore, the respondents understand the importance of not-direct instruments development as the base for long-term economic entities development of electric power sector, without which ensuring the stability of electric power industry development is impossible.

Figure 4 shows the results of priorities evaluation during the process of government support instruments applying for stable development of electric power industry in Ukraine. The analysis of these results shows that the majority of respondents preferred the development stimulation, implementation and increasing innovations as the strategic base for the development (middle point 4.16). Alongside, it is important to pay attention to the solving ecological problems.

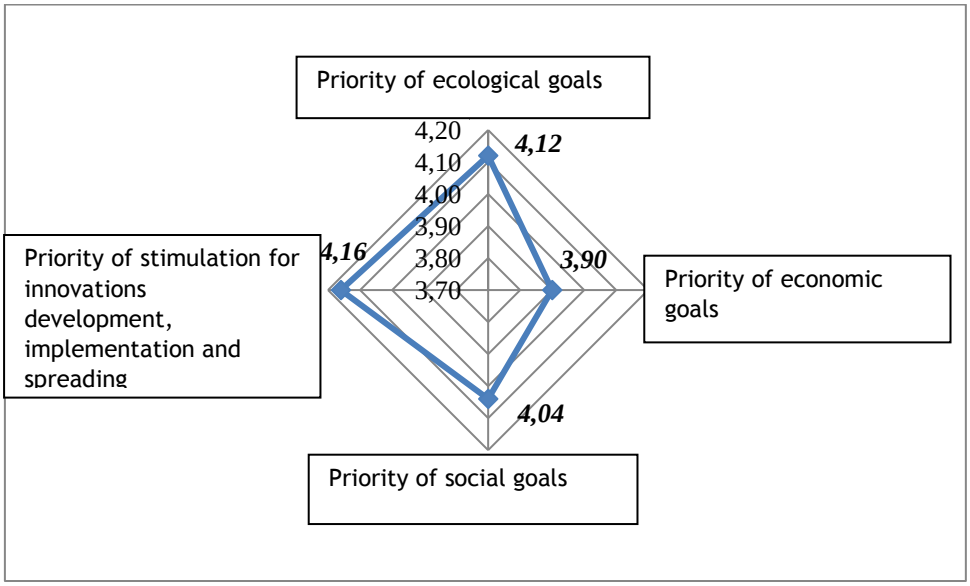

Figure 4. Average Priorities Evaluations during the Process of Government Support Instruments Applying for Stable Development of Electric Power Industry in Ukraine

The scenarios for government support instruments applying for stable development of electric power industry in Ukraine based on the selection matrix of scenarios and determined priorities, innovations with simultaneous ecology support, can be defined in the following manner:

– Scenario No. 1 – Activation of innovation activity in the direction of ensuring the development due to innovations in the sphere of decreasing resource intensity, applying regenerating energy resources, decreasing discharge in air, energy efficiency and energy saving

– Scenario No. 2 – Activation of State financing in the direction of state support in decreasing resource intensity, applying regenerating energy resources, decreasing discharge in air, energy efficiency and energy saving

– Scenario No. 3 – Activation of long-term not-direct support instrument in the direction of ensuring the development due to creation favorable conditions for decreasing resource intensity, applying regenerating energy resources, decreasing discharge in air, energy efficiency and energy saving (tax reliefs, special tariff rates, etc. for ecological safe and resource saving technologies).

Preparing the scenarios for government support instruments applying for stable development of electric power industry is an important factor of financial support for increasing competitive ability of electric power sector based on the most effective use of resources, for which it is needed to:

- determine need in total amount of resources for financing innovation activity;
- determine possibilities to ensure need in investment resources due to various resources;
- determine the methods of financing individual programs and projects on development;

- optimize the structures of resources of forming financial resources for investing the stable development ensuring.

During the realization of scenarios for government support instruments applying for stable development of electric power industry it is needed to pay attention to the following items:

- creation of balances integral structure of State resources directed at the development of electric power enterprises and development of such structure management model;
- evaluation of electric power enterprises reactions on change in environment conditions both favorable and not favorable (protection against negative development of events and applying positive tendencies);
- optimization of government support instruments applying in order to use them in the most effective way for achieving strategic goals of the sector stable development;
- increasing competitiveness on every direction of electric power industry activity for adequate reaction on the competitors' actions (including timely "withdraw" from the activity spheres where Ukrainian electric power industry has no serious competitive benefits);
- selection of variants for obtaining internal and external benefits due to balancing individual subsystems of stable development potential as the base for achieving synergic effect of electric power sector activity.

Discussions

The following scientists-economist have studied the directions and priorities of government support of electric power industry: D.V. Zerkalov (2012), S.M. Leonova (2015), N.M. Mel'tyukhova (2010), S.V. Naraevs'kyj (2015), L.A. Puchkov (2014), A.V. Fedorchenko (2014), M.S. Filyak (2013) and others, but a lot of problems are still not solved.

In terms when the only way to ensure renovation and development of Ukrainian energy system is to perform the reform of electric power market allowing to create clear rules of the play on it and to step up competition, the companies-participants of this market even today have to start preparation for future changes.

Functioning of electric power enterprises in terms of increasing effect of competitiveness factors is impossible without creation of management mechanisms which would allow the company's management to trace changes and tendencies in functioning environment, determine danger and possibilities, forecast their effect on the company activity in the future based on what shall be used for setting long-term goals and to develop strategies realization which would ensure successful long-term development (Puchkov, 2014).

Nowadays the enterprises of electric power sector are planning to enter new period that differs in the methods and rules for activity conducting.

The reason for this is the need in overcoming the range of problems accumulated by the sector to the current moment. The most serious are: increasing ageing process of generating and electricity supply equipment (for

example, wear of electricity supply equipment of electric power supply companies equals to 70%); insufficient capacity of electric power networks in some regions of Ukraine, that results in limitation of using powers and generation of electricity power in some electric power plants, decreases reliability of consumers' electric supply; cross-subsidisation (domestic consumes due to industrial enterprises); decrease of science and technical potential of the sector; incompleteness of creation regulatory base of electric power enterprises functioning concerning new economic conditions; lack of current assets; accumulation of accounts receivable of electric power companies; imperfection of accounting systems, etc. (Naraevs'kyj, 2015).

Thus, solving these and other problems of electric power industry is possible only providing rethinking of approaches to creation State policy and system rebuilding of sector's enterprises activity.

Conclusion

In modern terms of Ukrainian electric power sector, functioning requirements to adaptability of management systems and innovation development are increasing. Simultaneously, the problem of ecological safety becomes the priority factor that determines both technologies of modern production capacities in electric power industry and cost for raw materials on world markets, etc. High dynamism of environment factors, rapid changes in social and economic processes require appliance of new management technologies, including performing diagnostic for potential development possibilities and making solutions in terms of uncertainty and risk.

It is proposed to perform program-purpose management of stable development of electric power industry based on strategic approach to determination of development scenarios where strategic variation priorities of development are formed being the base for determination the goals in purpose programs of stable development of electric power industry. This management shall be directed at creation of conditions concerning achievement of optimal correspondence between potential possibilities of the State and other entities of electric power sector and priority requirements to environment. The stable development of electric power industry in terms of constant transformation of environment is possible by applying the transfer to quite new state, higher level of innovation development, level of competitive ability, productivity and effectiveness of the activity, development of alternative energy, increasing energy efficiency.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Svitlana I. Vikhlyaeva is PhD in Economics, Professor of National Technical University “Kharkiv Politechnic Institute”, Kharkiv, Ukraine.

Li Chao is Post Graduate Student of National Technical University “Kharkiv Politechnic Institute”, Kharkiv, Ukraine.

Nataliya V. Vikhlyaeva is Post Graduate Student of National Technical University "Kharkiv Politechnic Institute", Kharkiv, Ukraine.

References

Fedorchenko, A. V. (2014) Methods of Achievement and Determinates of International Energy safety. *Innovations and Investments, 2*, 97-100.

Filyak, M. S. (2013) Some Items on Balance in Strategies of Stable Development and their Connection to Technological Principles. *Nauchnyj Vestnik, 15*, 392-400.

Leonova, S. M. (2015) Inner Mechanisms of Value Harmonization of the Sector Development Programs. Eastern-European. Journal of Advanced Technologies. *Integrated Strategic Management, Management of Projects and Programs of Enterprises and Territories Development, 2 (63),* 45-48

Mel'tyukhova, N. M. (2010) State Management as Harmony of Activity and Relations. Kharkiv: Magistr. 204p.

Naraevs'kyj, S. V. (2015) *Competitive Ability of Alternative Technologies for Energy Obtaining* (Unpublished master's thesis). Economics and Company Management. 260p.

Puchkov, L. A. (2014) Forecast for Mineral-Energy Consumption in Case of Crisis-Free Economics Development. *Miming Journal, 7*, 45-48.

Zerkalov, D. V. (2012) Energy Saving in Ukraine. Monograph. Kyiv: Osnova. 582p.