Methodological approaches to forecasting of electric power production in the innovation development context
Khansevyarov R. (Russian Federation)
Методические подходы к прогнозированию производства электроэнергии в контексте инновационного развития
Хансевяров Р. И. (Российская Федерация)

Хансевяров Рустам Идрисович / Khansevyarov Rustam - доктор экономических наук,
кафедра экономической теории,
Самарский государственный экономический университет, г. Самара

Abstract: *the present paper is a consideration of improving operation of the electric power complex. The existing prerequisites and possibilities have determined the development line of the electric power complex innovation activity. An emphasis is made on the rational implementation of innovations acceptable in the modern economic conditions, with taking into account demands of the electric power complex.*
Аннотация: *в представленной статье рассматривается совершенствование деятельности электроэнергетического комплекса. Существующие предпосылки и возможности определили направленность развития инновационной деятельности электроэнергетического комплекса. Акцент сделан на целесообразное внедрение инноваций, приемлемых в современных экономических условиях с учетом потребностей электроэнергетического комплекса.*

Keywords: *innovations, innovation development, electric power complex.*
Ключевые слова: *инновации, инновационное развитие, электроэнергетический комплекс.*

Electric power production is a fundamental sphere for any country of the world. To maintain sustainability of economic processes, there is necessity in continuous improvement of innovation activity of the electric power complex. Electric power engineering can be deemed belonging to priority sectors of the economy.

The electric power complex is featured with high inertance and utilization of hi-tech equipment. Perfecting of the electric power complex innovation activity is related to conducting of the research work with attracting high-skilled specialists, considerable investments and availability of a scientific-research base. Implementation of the obtained results, as a rule, takes place under support of laws and regulations accepted in this country.

In Russia, perfecting of the electric power complex innovation activity may be referred to open-type innovations wherein acquiring of new techniques and imitation of laws and regulations adapted to peculiarities of the Russian electric power complex occur.

Electric power is the basis of development of the country's economic system. Practically any type of activity will require electric power available which is used, in this or that way, in most phases of production processes. A great disadvantage of electric power production is ample quantity of carbon dioxide emitted into atmosphere.

In this relation, there is necessity in constant perfecting of the electric power complex innovation activity.

Impossibility to store electric power in large-scale amounts is one of specific features thereof as a commodity. To provide failure-free operation of an electric power system, one needs to have predicted data about the output (consumption) of electric power and take them into account when planning amounts and power of production facilities.

Falling into the category of innovations in electric power engineering are technological developments, implementation of new energy sources, improvement of operation efficiency of the electric power complex with purpose of reduction of polluting emissions, gross loss of electric power and GDP specific power consumption, perfecting the regulatory basis both within the country and abroad.

Falling into the category of innovations and innovation activity in electric power engineering are technological developments, implementation of new energy sources, improvement of operation efficiency of the electric power complex with purpose of reduction of polluting emissions, gross loss of electric power and GDP specific power consumption, perfecting the regulatory basis both within this country and within the common electric power market which is in process of creation in EurAsEC framework.

In no case implementation of innovations should jeopardize the basic operation principles of a power system, that is, reliability and safety.

In Russia there is a need to be focused on a rational combination of own scientific and engineering resources and foreign sources of knowledge and technologies, i.e. holding to the dual strategy which includes innovation opportunities and absorption abilities.

Development and perfecting innovation and innovation activity should pass along the following essential lines:

- Innovation development inside the country supporting on your own efforts.
- On basis of international cooperation within programs and projects aimed at creation of incremental, differential and destructive innovations.

The level of innovation development will depend on a number of factors which exerts an impact on the level of innovation development of the electric power complex.

Innovation technologies allow reduction of energy supply consumption at provision of a necessary level of electric power generation. For example, reduction of electric energy losses, development and implementation of innovation generating sources will allow reducing consumption of fossil energy resources with simultaneous maintaining the necessary level of production.

The amount of emitted carbon dioxide in course of operation of an electric power complex may be reduced by means of implementing innovation technologies aimed at perfecting of the production process of electric power generation, diversifying production facilities and utilizing modern innovation technologies on collecting, transportation and storage of carbon dioxide.

In various countries, evaluation of GDP dependence on primary energy delivery, dependence between indexes of CO_2 emissions at production of electric and heat power and internal expenses for studies and developments shall be conducted with use of the correlation-regression analysis.

Correlation analysis is a group of technical devices which are used for measuring the relation between two variables.

The correlation factor will describe the constraint force between two data arrays. The factor takes values from -1 to 1 inclusively. The correlation factor taking values either -1 or 1 demonstrates the absolute data correlation.

In case when correlation is absolutely missing, the factor will be zero. The correlation factor will be defined by the formula:

$$r = \frac{\Sigma[(X - \bar{X}])(Y - \bar{Y})}{n - 1} s_x s_y, \quad (1)$$

where X – the value of an independent variable, $\bar{X}$ – the average value of independent variables; Y – the value of a dependent variable, $\bar{Y}$ – the average value of dependent variables; n – the number of observations; s_x – the standard deviation of a multitude of independent variables; s_y – the standard deviation of a multitude of dependent variables.

The determination factor is a quantitative interrelation of the general deviation of the dependent variable Y which is referred to the deviation of the independent variable X. For example, when R^2 is equal to 0.50, we may say that 50 % of deviations of the dependent variable Y are referred to the deviation of the independent variable X.

Plotting an equation for evaluation of a linear dependence between the two variables is referred to as the regressions analysis.

A linear equation for evaluation of the dependent variable X is referred to as a regression equation. When plotting a regression equation, the least square principle will be used which contemplates minimization of the sum of squares of vertical distances between actual values of the dependent variable Y and predicted values of the dependent variable Y.

A linear regression equation will be put down like that [2]:

$$\hat{Y} = a + bX, \quad (2)$$

where $\hat{Y}$ – a predicted value of the dependent variable Y for a certain value of the independent value X; a – the point of crossing the axis of ordinates, i.e. the predicted value of the dependent variable Y at the value of the independent variable X equal to zero,

b – slope of the line, i.e. the average change of value $\hat{Y}$ for each change per unit of the independent variable X; X – a selected value of the independent variable X.

The slope of the regression line will be defined by the formula:

$$b = r \frac{s_y}{s_x}, \quad (3)$$

where r – the correlation factor; s_y – the standard deviation of a multitude of dependent variables; s_x – the standard deviation of a multitude of independent variables.

Crossing with the axis of ordinates will be defined by the formula:

$$a = \bar{Y} - b\bar{X}, \quad (4)$$

where $\bar{Y}$ – the average value of dependent variables Y; $\bar{X}$ – the average value of independent variables X.

Total losses of electric power are an important index of the electric power complex innovation development.

Reduction of electric power losses can be achieved by means of renewal of the electric power complex capital fund, by means of strengthening of the scientific-research vase inside the country and joining to international research organizations involved into innovation developments in the scope of electric power engineering.

To achieve a new way of electric power production in this country, it is proposed to develop renewable energy sources, which, in the long run, can compensate for lack of conventional energy sources and reduce the level of contaminant emissions in the atmosphere in course of generating electric and heat power.

Acquisition of renewable resources will not require significant expenses for excavation, transportation and storage, or for further disposal, like in a case with burying wastes of thermal and nuclear power plants, for instance.

To ensure that economic growth would not lead to increased carbon dioxide emissions, one has to implement innovation energy-saving technologies in the most active way.

To achieve high results in reduction of carbon dioxide emissions, one has, simultaneously with innovation energy-saving and purging technologies, to be involved into diversification of power-generating facilities due to wide-scale implementation of renewable power resources following the principles of «green» economy.

Thus, the economic activity growth is the factor which exerts the biggest influence on increasing carbon dioxide emissions at thermal power plants.

So, the analysis of indexes of the electric power complex innovation development will be necessary in order to determine the level of adherence to the «green» economy and aiming at their innovation development.

References

1. *Bondarenko N. Ye.* Theoretical basics of the concept of innovation development of economy // Messenger of Altai Academy of Economics and Law // [Electronic resource]. Access: http://journal-aael.intelbi.ru/main/wp-content/uploads/2012/01/Н.Е.-Бондаренко.pdf.
2. *Krasnova N. A.* Innovations in various schools' economic theories // Economy and management of innovation technologies. - 2013. - № 12. // [Electronic resource]. Access: http://ekonomika.snauka.ru/2013 / 12/3476.
3. *Kuzyk B. N., Yakovets Yu. V.* Russia – 2050: The strategy of an innovation breakthrough. The second enlarged version. – Moscow: Economy, 2005. – 636 pages.
4. *Anishchik V. M., Rusetsky A. V.* Innovation activity and scientific and engineering development: a study guide / edited by N. K. Tolochko. – Minsk: Publishing centre of Belarus State University, 2005. – 151 pages.