УДК 621.311

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METHODOLOGICAL FOUNDATIONS OF ANALYSIS AND FORECASTING OF GAS CONSUMPTION IN THE SYSTEM OF ENERGY BALANCE OF UKRAINE BY USING THE GROUP METHOD OF DATA HANDLING

This research deals with issues of gas consumption in Ukraine. The dynamics of consumption of gas is analysed and proposed guidelines for the efficient production, consumption and import of gasin Ukraine. Constructed and developed predictive models of gas consumption in Ukraine through the use of modern software and using the group method of data handling, which allowed building adequate predictive models of gas consumption in the system of Ukraine's energy balance. Researched and forecasted scenarios of gas consumption in the Ukraine.

The problem of efficient use of energy resources is critical for sustainable economic development against the backdrop of energy saving national economy depends on energy imports, on the one hand, and rising prices for these resources. The basic foundation of the formation energy system of Ukraine is to build forecasting scenarios for different types of energy and different criteria for effective use of energy resources. Solving this problem is not only with ensuring energy security, but also with the level of development of regions of Ukraine and ensuring quality of life.

Prediction of gas consumption in Ukraine today is an extremely important issue of strategic importance since conducted through analysis and building predictive models will be possible to develop guidelines for the efficient production and consumption of gas across Ukraine as a whole.

Keywords: energy conservation; energy efficiency; energy balance; energy statistics.

Formulation of the problem. Construction and development of predictive models for the consumption of gas in Ukraine by using the group method of data handling and by using modern software.

Analysis of recent research and publications. In [2] is shown the comparison as previously proposed and those developed methods for short-term forecasting of gas consumption: regression analysis, neyronnoh networks and fuzzy neural networks. Intensive development of software products aimed at predicting gas [3], theory and practice modeling, forecasting processes in new ways raises the question of developing a new multi multivariate predictive model that will take into account more factors and performance unlike other predictive models. In the article forecasting scenarios of gas consumption in Ukraine are build by using group method of data handling.

The aim of the study. The study aims to develop methodological provisions for forecasting the gas consumption in Ukraine by using the group method of of data handling.

The main material of the research. The level of energy has a decisive impact on the economy of the state, resolving social problems and living standards of citizens. Changes in energy prices immediately reflected in all industries, and the rest, the price of the final product. Therefore, instead of quantitative objectives of energy development, which was followed by Ukraine's economy in recent decades, energy has to go to power sustainable economic development, focused on that now developed countries. The said research leads scientists to balance the energy balance of Ukraine, which determined the relevance of the work. In the traditional understanding of energy balance is the ratio between the extraction (production) and consumption of different types of energy resources.

At the heart of the development of fuel and energy balance is a set of strategic statements of economic development, the definition of forecast volumes of energy consumption, based on adopted policies to increase energy efficiency, the development of fuel and energy complex and evaluating opportunities extraction and production of fuel and energy, as well as the formation of areas of import – export policy and determine the volume of purchase and sale of energy.

One of the mathematical methods of forecasting is group method of data handling, which allows you to build adequate predictive models of energy consumption in the system of Ukraine's energy balance.

With the help of a group of data handling and by using modern software were built predictive models of consumer energy resources of the system energy balance of Ukraine:

1. Predictive system model, 2 lags:

$$Y(1) = 0,3197*Y1(-1) + 0,7452*Y1(-2) + 0,0036*Y3(-2)$$
$$Y(2) = 45.4376 + 0,3214*Y3(-1) + 0.1638*Y3(-2)$$
$$Y(3) = 95.9092 - 2.2548*Y1(-2)$$

Table 1

Initial data for gas production

Year	Gas production, billion m³	Consumption of gas, billion m³	Imports of gas, billion m³
	Y1	Y2	Y3
2006	21,5	75,1	54,1
2007	22,4	73,6	52,8
2008	23,8	71,3	47,5
2009	24,2	69,5	45,4
2010	25,5	67,6	42,1
2011	26,3	66,2	40,3
2012	27,9	65,5	39,6
2013	28,1	64,9	37,2
2014	29,7	63,7	33,6
2015	31,1	62,4	31,3

Results of approximation and forecast for the next 5 years.

The first indicator $Y1$ – Gas production, billion m³ is given in table 2.

Table 2

Gas production, billion m³

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
Table	21,5	22,4	23,80	24,20	25,50	26,30	27,90	28,10	29,70
Forecast	–	–	23,38	24,36	25,38	26,44	27,53	28,65	29,81

Year	2015	2016	2017	2018	2019	2020
Table	31,10	–	–	–	–	–
Forecast	31,02	32,20	10.30	27,39	16,78	25,86

The second indicator $Y2$ – Consumption of gas, billion m³ is given in table 3.

Table 3

Consumption of gas, billion m³

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
Table	75,1	73,6	71,30	69,50	67,60	66,20	65,50	64,90	63,70
Forecast	–	–	71,27	69,33	67,80	66,76	65,68	64,58	63,44

Year	2015	2016	2017	2018	2019	2020
Table	62,40	–	–	–	–	–
Forecast	62,26	61,00	54,74	81,01	68.64	72,62

The third indicator $Y3$ – Imports of gas, billion m³ is given in table 4.

Table 4

Imports of gas, billion m³

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
Table	54,1	52,8	47,5	45,4	42,1	40,3	39.6	37,3	33.6
Forecast			48,49	45,56	42,61	40,02	37,64	35,47	33,48

Continuation of Table 4

Year	2015	2016	2017	2018	2019	2020
Table	31,3	–	–	–	–	–
Forecast	31,66	29,79	19,39	21,27	19,49	18,89

Interconnection between imports of gas and petroleum:

$$Y1= 0.9017*Y1(-1) + 0.0775*Y2(-2);$$
$$Y2= 0.0369*Y1(-1) + 0.6177*Y2(-1) + 0.2820*Y2(-2).$$

Fourth indicator Y4 – Petroleum imports, mln t is given in table 5.

Table 5

Petroleum imports, mln t

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
Table	15,5	16,8	18,30	21,90	23,30	24,60	25,10	25,70	26,30
Forecast	–	–	19,34	21,53	23,17	24,42	25,32	25,93	26,29

Continuation of Table 5

Year	2015	2016	2017	2018	2019	2020
Table	26,70	–	–	–	–	–
Forecast	26,68	26,68	24,05	24,0	23,14	22,51

Forecasted consumption patterns and gas such important indicators as gas, everything billion m^3 gas consumption, everything billion m^3, import of gas, everything billion m^3 oil imports, total mln tons. The authors were built predictive models and developed guidelines and conclusions on possible scenarios for the development of the gas system in Ukraine's energy balance. Using group method of data handling for the construction of gas consumption forecasting scenarios enabled to view advanced options for the future development of energy sector in Ukraine for 5 years and made it possible to see clearly at that scenario may evolve gas sector in Ukraine and were forecasted and mentioned most important strategic key energy indicators.

Conclusions. Through analysis of the dynamics of gas consumption in Ukraine and analysis of such important indicators as gas, everything billion m^3 gas consumption, everything billion m^3, import of gas, everything billion m^3 oil imports, total, mln tons – were built predictive models in the gas by using group method of data handling for the above indicators and made the following results:

– forecasted the growth of gas production, from 21,5 billiom m^3 in 2006 to 25,86 billiom m^3 in 2020;
– forecasted the decreasing of consumption of gas from 75,1 млрд. м^3 in 2006 to 72,62 billiom m^3 in 2020;
– forecasted the decreasing of imports of gas from 54,1 billiom m^3 in 2006 to 18,89 billiom m^3 in 2020;
– forecasted the growth of petroleum imports from 15,5 mln t in 2006 to 28,23 mln t in 2020.

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