UDC 621.311[i]

Rashed Almabrok
Power Supply Department

THE STUDY OF MOTHLY TIME SERIES OF POWER CONSUMPTION OF AN INDUSTRIAL ENTREPRISE WITH A CONTINUOUS CYCLE OF WORK

Abstract*. The scientific paper proposes the use of a combined data recovery method that combines local and global recovery methods. Nowadays, local and global data recovery methods are among the most widely used ways to recover lost information. The spread of these methods is concerned with the fact that, applying them, we can get the best result of data recovery. The proposed information recovery approach provides for optimization of the choice for solving the assigned problems. As an assessment of the results obtained, the source data are compared with the data obtained by local and global recovery methods using the relative error. It also compares the economic result of data recovery compared to the methods used by power supply organizations. The results of data recovery studies are proposed to be used as recommendations for the recovery of lost accounting values for energy consumption.*

Key words: *method, data recovery, local, global, diagrams of electrical loads, simulation, statistical method, approximation, relative error.*

Introduction. When entering metering values on the level of consumption of resources there can be operation failures in counter devices. In order to prevent data loss and reduce its negative consequences, it is necessary to find out the reasons for which they occur. The information stored in the counter devices is extremely vulnerable, and various factors can cause damage to it [1].

When accounting data are lost, there is a need to recover them. The difficulty of lost data recovery arises due to the diversity of consumption schedules. In order to solve this problem, it is necessary to develop a comprehensive approach to the process of recovery of unregistered values. The scientific paper proposes the use of a combined data recovery method that combines local and global recovery methods [2].

Purpose and objectives of the research. Based on the study of real graphs of electrical loads show all the possibilities of using arrays of credentials for solving various power supply and energy savings task (calculating losses, determining coefficients of electrical graphs ,calculating loads ,controlling maximum load, etc.…) ,showing the degree ,the effectiveness of the use of samples of a certain duration

Research materials and results.

Data recovery with the use of local methods. Data recovery was carried out by sorting the volume of ammonia production from the minimum to the maximum value. Then the sample was evaluated for a smooth change in the levels of resource consumption (energy and gas). In the case of chaotic change in parameters, the initially distorted values were excluded (in our case, these are the 2 first indicators) [3].

Then, in each sample of values, deviations of samples from the initial value are determined within their limits.

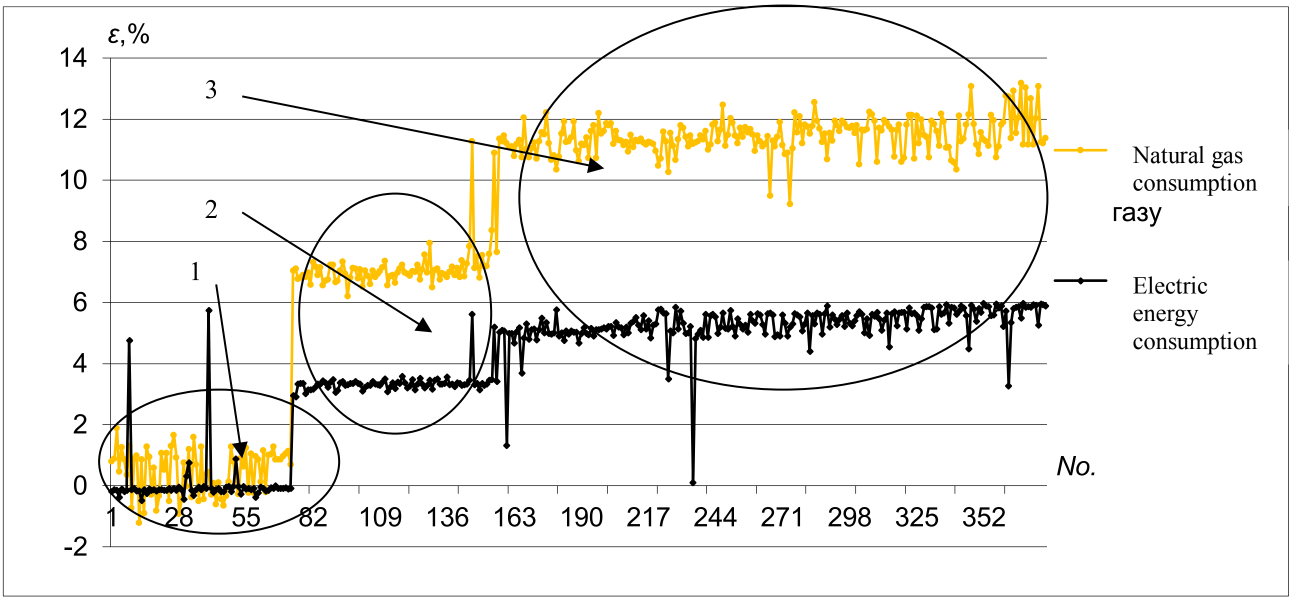

Figure 1 – Deviation of the values of the samples relative to the original value within the studied data sample

From Figure 1 it follows that the data is changing in discrete steps and it is necessary to sort the information by segments. Let us show them in a more representative form.

The description of the values of the first segment can be given as a range [-1; 2], but the accuracy of the calculations will first decrease by 3% [4].

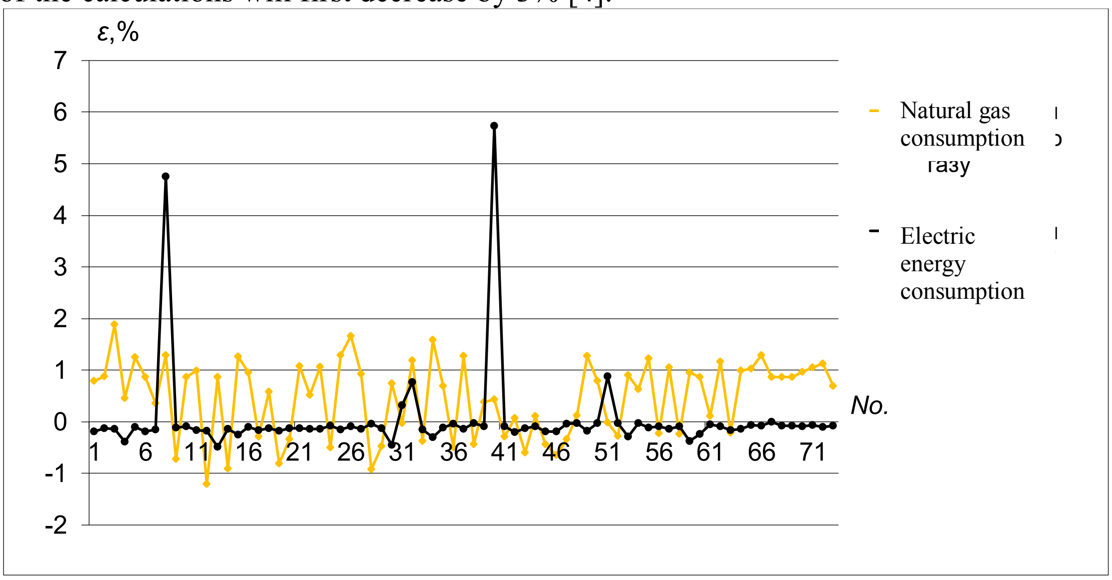

Figure 2 – Deviation of the values of the samples in relation to the initial value within the studied data sample when the ammonia production is changed from the minimum value to 5 tons (segment 1 of Figure 1)

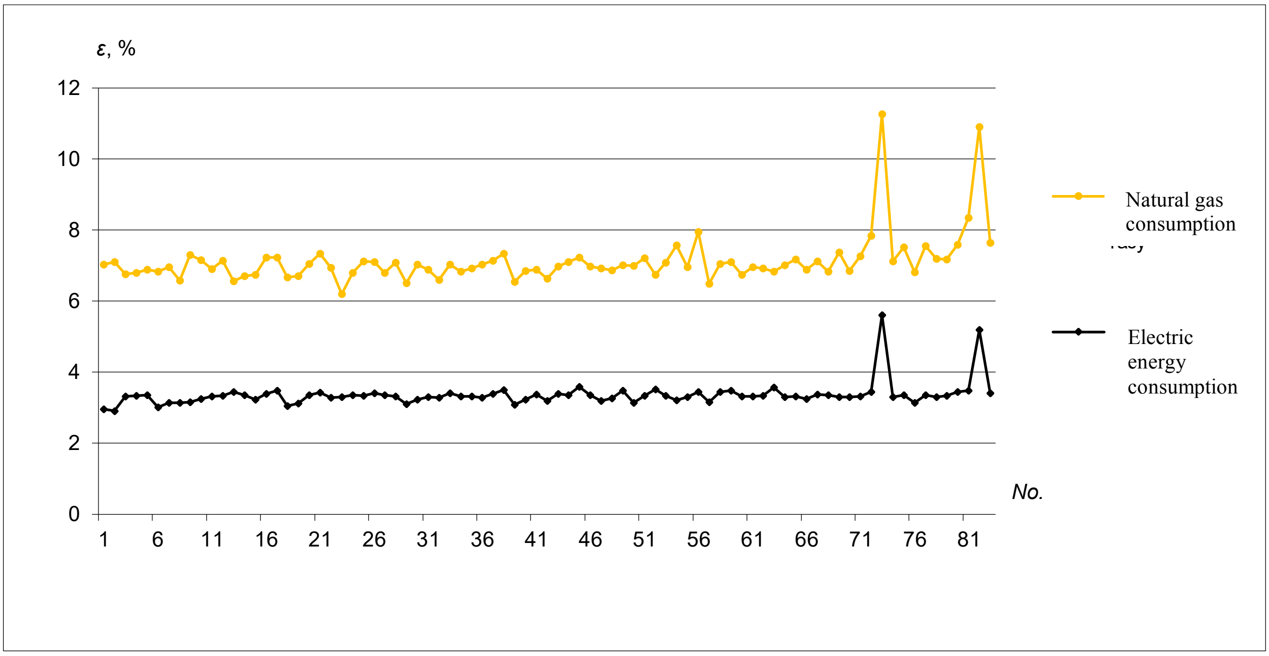

Figure 3 – Deviation of the values of the samples in relation to the initial value within the studied data sample when the ammonia production is changed from 5 to 10 tons (segment 2 of Figure 1)

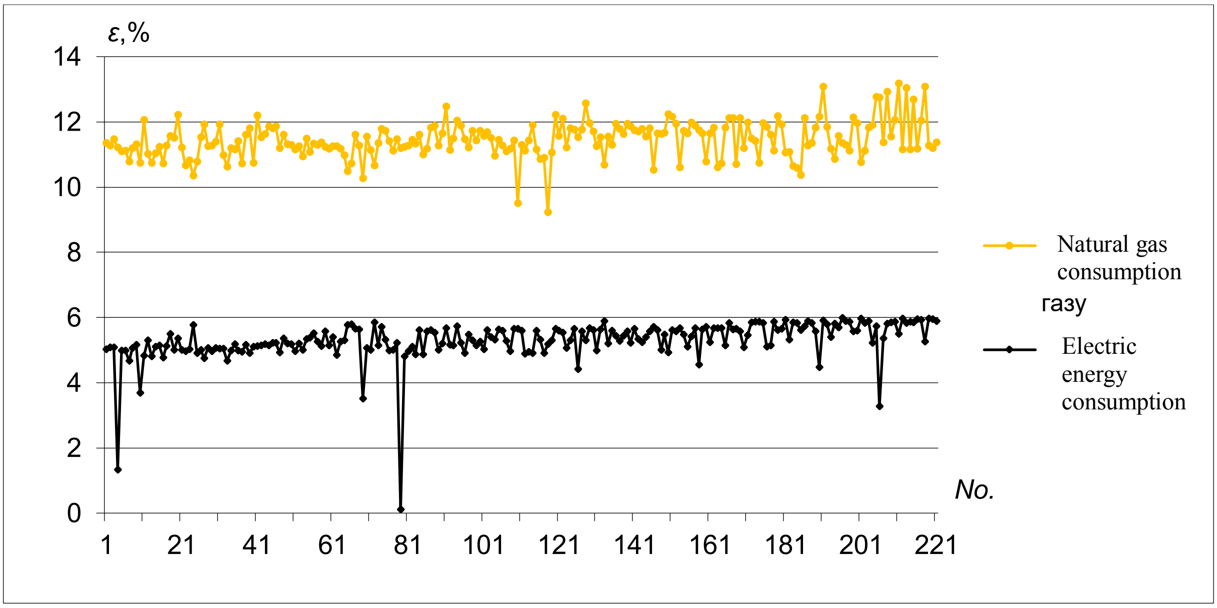

Figure 4 – Deviation of the values of the samples in relation to the initial value within the studied data sample when the ammonia production is changed from 10 tons through the maximum value (segment 3 of Figure 1)

From Figures 3 and 4 it follows that with a known sense of ammonia production, it is possible to determine the amount of electricity consumed and double-check the results by the amount of natural gas consumed. In these cases, the resource costs are described by a linear law [5].

Data recovery with the use of global methods. We have data for two periods about the enterprise that consumes natural gas and electricity and produces ammonia. During these periods, no technological changes have occurred, that is, the characteristics of production are similar [6].

In the first period (the spring period) there were no failures and all accounting data were recorded. However, in the second period (the summer period), part of the data on electricity consumption was lost. There was a need for their recovery. The technological process for a given period has a similar character; then, having found the characteristics during the spring period, they can be used to recover data in the summer period.

Let us illustrate the dependence of the used power (see Figure 5) and the consumption of natural gas (see Figure 6) on the production of ammonia during the spring period.

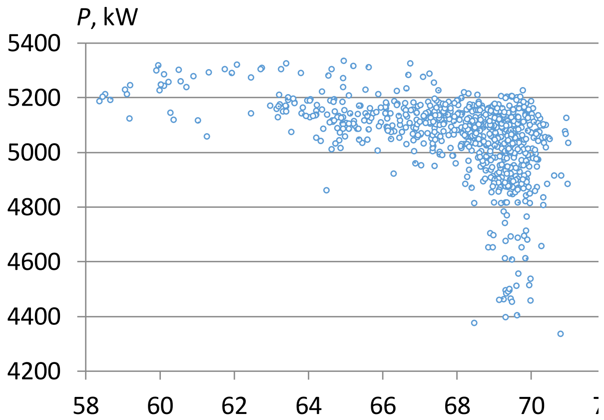

Figure 5 – Dependence of used power on ammonia production

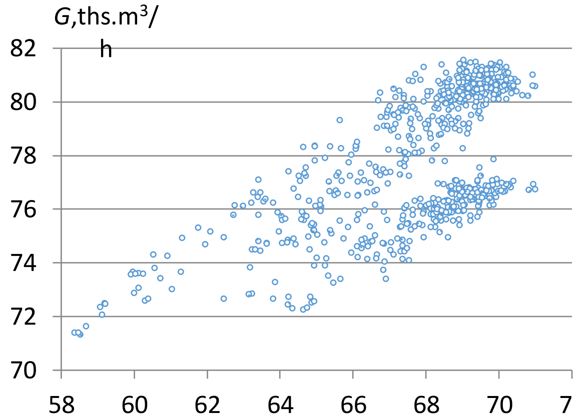

Figure 6 – Dependence of natural gas consumption on ammonia production

Since one value of the produced ammonia corresponds to a certain range of values of consumed natural gas and the power used, we will put in order the value of ammonia from minimum to maximum and for each of them we will find the range of values of natural gas and power. For convenience, we will work with dependences of minimum natural gas consumed on ammonia (Gmin = f(A)), power used (Pmin = f(A)), and dependences of the difference between the maximum and minimum value of natural gas on ammonia (ΔG = f(A)) and power (ΔP = f(A)). Figures 7 – 10 show the obtained dependences [7].

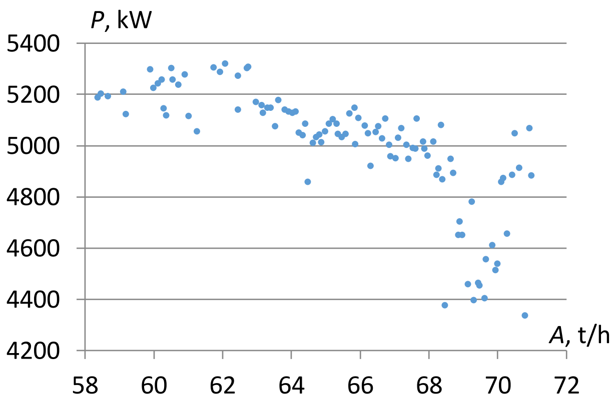

Figure 7 – Dependency Pmin = f(A)

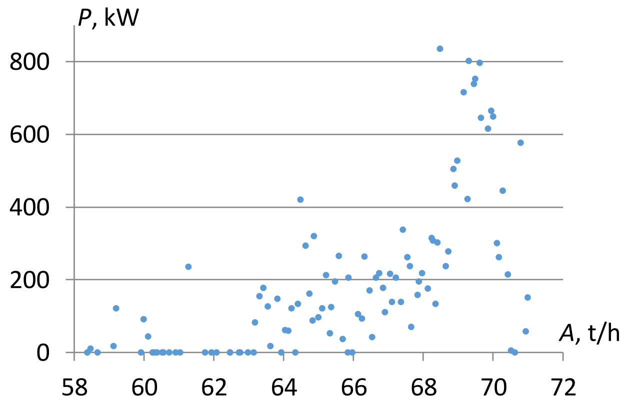

Figure 8 – Dependency ΔP = f(A)

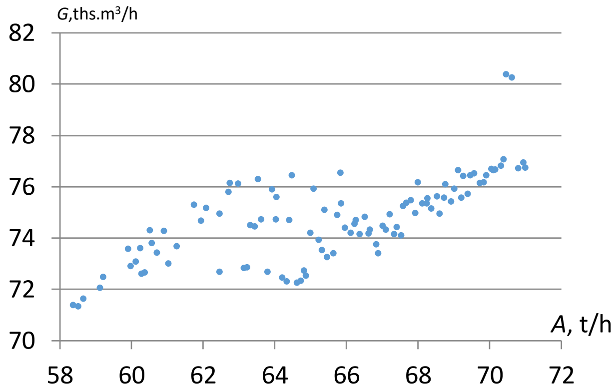

Figure 9 – Dependency Gmin = f(A)

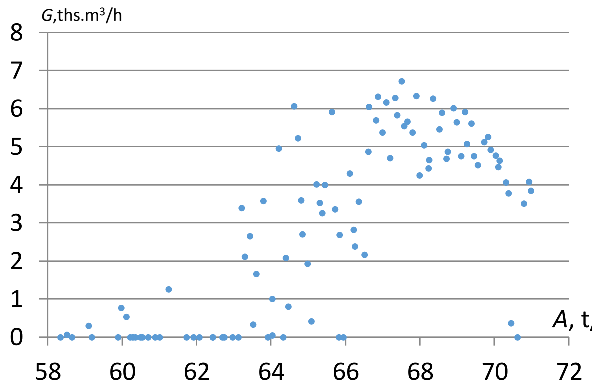

Figure 10 – Dependency ΔG = f(A)

Conclusion. As a result of the research, it was found that at the enterprise there is no universal method for electricity consumption data recovery, which in all cases yields a result with minimal error. When recovering lost data, it is necessary to analyze the type of function.

References:

1. Zinkevich V. S. Informatsionnyye riski: analiz i kolichestvennaya otsenka [Information risks: analysis and quantification] / V. S. Zinkevich, D. K. Shtatov// Moscow: Bukhgalteriya i blanki. – No. 1. – 2007. – (240 p. – book, P. 36 – 42 – journal) [in Russian].

2. Pravyla korystuvannya elektrychnoyu enerhiyeyu. Zatverdzheno postanovoyu Natsional′noyi komisiyi z pytan′ rehulyuvannya elektroenerhetyky Ukrayiny №28 vid 31 lypnya 1996 roku [Terms of use of electric energy. Approved by the resolution of the National Commission for State Regulation of Energy and Public Utilities No. 28 of July 31, 1996] // Biblioteka Zakon i biznes. – Kyiv, 1996, No. 109 [in Ukrainian].

3. Sayt Natsional′noyi komisiyi z pytan′ rehulyuvannya elektroenerhetyky [Website of the National Commission for State Regulation of Energy and Public Utilities] http://www.nerc.gov.ua/ [in Ukrainian].

4. Kavuniv V. V. Stvorennya intehrovanoyi rozpodilenoyi ASU TP enerhopostavlyayuchoyi kompaniyi iz zastosuvannyam systemy Trace Mode. ASU dlya promyslovykh pidpryyemstv. Promyslovi ASU i kontrolery [Creation of an integrated distributed ACS TP for a power supply company using the Trace Mode system. ACS for industrial enterprises. Industrial ACS and controllers] / V. V. Kavuniv, A. M. Lakiza, I. A. Lytvynenko. // "Nauchtekhlitizdat", 2005. – 270 p. [in Ukrainian].

5. Osika L. M. Kommercheskiy uchet elektroenergii: uroki i perspektivy [Commercial accounting of electricity: lessons and perspectives] / L. M. Osika // EnergoRynok. – 2006. – Vol. 32. – No. 7. [in Russian].

6. Budanov P. F. Model′ informatsiynoho zabezpechennya zavdan′ obliku elektroenerhiyi [Model of information support for electricity accounting tasks] / P. F. Budanov, Z. Z. Beybutova, B. O. Korolyuk, T. V. Shurda, D. M. Shalyhin. // Systemy ozbroyennya i viys'kova tekhnika – No. 1 (25) – 2011. [in Ukrainian].

7. Tekhnichni ta orhanizatsiyni vymohy do pobudovy avtomatyzovanykh system obliku elektroenerhiyi na ob'yektakh NEK "Ukrenerho" [Technical and organizational requirements for the construction of automated electric energy accounting systems at the NPC "Ukrenergo" facilities] / Approved by the Sciences and Technical Council of the NPC "Ukrenergo", minutes No. 5 of March 29, 2000 [in Ukrainian].