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JOURNAL	International Journal of Innovative Technologies in Economy
p-ISSN	2412-8368
e-ISSN	2414-1305
PUBLISHER	RS Global Sp. z O.O., Poland

ARTICLE TITLE	ON THE FINANCIAL ASSESSMENT OF THE NKR ELECTRICITY SYSTEM
AUTHOR(S)	Mikayelyan Yevgenya
ARTICLE INFO	Mikayelyan Yevgenya. (2021) On the Financial Assessment of the NKR Electricity System. International Journal of Innovative Technologies in Economy. 3(35). doi: 10.31435/rsglobal_ijite/30092021/7682
DOI	https://doi.org/10.31435/rsglobal_ijite/30092021/7682
RECEIVED	16 August 2021
ACCEPTED	22 September 2021
PUBLISHED	25 September 2021
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ON THE FINANCIAL ASSESSMENT OF THE NKR ELECTRICITY SYSTEM

Mikayelyan Yevgenya,
applicant of Artsakh State University, Republic of Artsakh

DOI: https://doi.org/10.31435/rsglobal_ijite/30092021/7682

ARTICLE INFO

Received 16 August 2021
Accepted 22 September 2021
Published 25 September 2021

KEYWORDS

Innovative technologies, energy strategy, competitive advantages, electricity generation, expansion policy, exchange rate.

ABSTRACT

The article aims to calculate the separate elements of the financial strategy of the NKR energy system and to carry out a factor analysis. Using the Kaufmann-Calibardi method, the coefficients of flexibility of electricity consumption by GDP were estimated, showing the causes of the shadow economy in the Artsakh Republic depending on the volume of electricity. Based on the annual statistics of electricity consumption and real GDP in the period of 2000-2019, the years were emphasized, as a result of which the fact that it is a calculated value of 1 substantiates the fact that the higher the electricity consumption, the higher the GDP should be, but obtained the results are not equal to 1 (greater than or less than 1), so the size of the shadow was calculated in those years.

Citation: Mikayelyan Yevgenya. (2021) On the Financial Assessment of the NKR Electricity System. *International Journal of Innovative Technologies in Economy.* 3(35). doi: 10.31435/rsglobal_ijite/30092021/7682

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Structural changes in the electricity and gas markets, as well as the emergence of innovative technologies, contribute to the fact that traditional approaches to strategy development no longer meet expectations. At the same time, the strategy of the energy companies should include new systemic approaches, such as technology equipment companies already having a competitive advantage in the energy market as they supply state-of-the-art utility equipment (industrial equipment sensors or Nest programmable thermostats). In the case of new software products, these companies are in an advantageous position to offer new products based on expert knowledge and cannot be duplicated by energy companies.

International availability, financial stability, economies of scale and experience with mass consumers allow these companies to gain market share in the new energy economy.

Consequently, energy companies carefully study each stage of the strategy in order to maintain a stable position in the market and further expand the policy: these are the competitive position, the emergence of new competitors of energy companies, opportunities and obstacles to entering traditional or new markets, etc. This means that the strategy of energy companies is radically transformed into the goals of applying new approaches and tools.

Therefore, the task was set in the work to calculate individual elements of the financial strategy of the NKR energy system and to conduct a factor analysis.

According to Table 1, in 2019, compared with 2000, the volume of production, consumption and export of electricity increased by 436.2 million kWh, 238.6 million kWh and 4.6 million kWh, and the volume of imports and losses of electricity decreased, respectively by 102.3 million kWh and 25.4 million kWh. And in 2019, compared to last year (compared to 2018), the volume of production, consumption and losses of electricity increased by 90.7 million kWh, 22.2 million kWh and 1.7 million kWh, due to the decrease in export and import volumes by 42.1 million kWh and 19.8 million kWh.

Table 1. In 2000-2019, analysis of indicators of electricity production, electricity consumption, electricity exports and electricity imports, electricity losses and electricity tariffs in the NKR[1]

Year	Electricity production (million kWh)	Electricity imports (million kWh)	Electricity exports (million kWh)	Electricity consumption (million kWh)	Electricity losses (million kWh)	Electricity tariff (AMD)
2000	43.1	117.4	5.5	155	68.8	14
2001	51.4	122.2	12.5	151.1	61	14.1
2002	108.6	72	33.3	147.3	54.5	14
2003	130.6	68.9	44	155.5	48.4	14
2004	137	77.3	44.6	169.7	46.6	14
2005	112.1	115.7	17.7	210.1	65.9	14
2006	69.1	154	3.4	219.7	61.1	16.8
2007	90.4	145.2	10.1	225.5	53.3	20
2008	97.1	132.7	5.7	224.1	45.2	20
2009	119.2	134.8	25.5	228.5	42.6	23.3
2010	177.6	96.3	41	232.7	39.5	25
2011	121.9	153.2	15.7	259.4	44.5	25
2012	164.5	118	18.8	263.7	46.2	25
2013	193.2	87.2	11	269.4	42.3	25
2014	224.5	78.1	14.4	288.2	45.3	25
2015	221.3	87.7	16.2	292.8	47.5	25
2016	296.5	31.6	29	299.1	45.9	25
2017	327.8	50.8	27.5	351.1	56.8	25
2018	388.6	34.9	52.2	371.4	41.7	25
2019	479.3	15.1	10.1	393.6	43.4	25

According to the data of Table 1 from 2000-2005, the average electricity tariff was 14 drams, in 2006, compared with 2005, the tariff increased by 2.8 drams, however, since 2007, an increase in the average electricity tariff was registered, in particular, in 2019, compared with 2008, the average electricity tariff increased by 5 drams and amounted to 25 drams.

In addition, the work highlighted and compared the prices for the export and import of electricity, as well as the exchange rate (compared to 1 US dollar) (see table 2). Thus, in 2019, as compared to 2000, the exchange rate in the NKR (compared to 1 US dollar) decreased by 59.07 drams, the volume of electricity exports increased by 4.6 million kWh, and import volumes decreased by 102.3 million kWh. However, in 2019, compared to 2018, the exchange rate (compared to 1 US dollar) decreased by 2.54 drams, and the volume of electricity export-import decreased by 42.1 million kWh and 19.8 million kWh.

[1] NSS of AR – yearbooks 2000-2006, 2006-2009թթ., 2009-2014, 2019,2020, pages 118, 175, 171-172, 203-204,212-213, http://stat-nkr.am/files/yearbooks/2000_2006/15.pdf, http://stat-nkr.am/files/yearbooks/2003_2009/19_Prom_161-181.pdf, http://stat-nkr.am/files/yearbooks/2008-2014/19_Prommet_159-160.pdf, http://stat-nkr.am/files/yearbooks/2019/14_Prommet_189-205.pdf, http://stat-nkr.am/files/publications/2020/Taregirq/14%20ardyunaberutyun.pdf.
NSS of AR – yearbooks 2000-2006, 2002-2008,2008-2014,2020, pages 276, 276, 276.,313, http://stat-nkr.am/files/yearbooks/2002_2008/21_Gner.pdf, http://stat-nkr.am/files/yearbooks/2008-2014/28_Gner_270-281+.pdf, http://statnkr.am/files/publications/2020/Taregirq/20%20gner_ev_sakagner.pdf.

Table 2. 2000-2019 electricity export, import and exchange rate of electricity (compared to 1 US dollar) in the NKR[1]

Year	Rate (compared to 1 US dollar)	Electricity imports (million kWh)	Electricity exports (million kWh)
2000	539.52	117.4	5.5
2001	555.08	122.2	12.5
2002	573.35	72	33.3
2003	578.76	68.9	44
2004	533.45	77.3	44.6
2005	457.69	115.7	17.7
2006	416.04	154	3.4
2007	342.08	145.2	10.1
2008	305.97	132.7	5.7
2009	363.28	134.8	25.5
2010	373.66	96.3	41
2011	372.50	153.2	15.7
2012	401.76	118	18.8
2013	409.63	87.2	11
2014	415.92	78.1	14.4
2015	477.92	87.7	16.2
2016	480.49	31.6	29
2017	482.72	50.8	27.5
2018	482.99	34.9	52.2
2019	480.45	15.1	10.1

The picture was different in the NKR in 2000-2019; in particular, according to the results of a comparative analysis of exports, imports and the exchange rate of electricity (1 Rub. compared to dram), in 2019, compared with 2000, the exchange rate (1 Rub. compared to dram) decreased by 11.62 drams, as a result of which the volume of electricity exports increased by 4.6 million kWh, and the volume of imports decreased by 102.3 million kWh. In addition, in 2019, compared to last year (2018), the exchange rate (1 Rub. compared to dram) decreased by 0.3 drams, and the volume of exports and imports of electricity decreased by 42.1 million kWh and 19.8 million kWh (see table 3).

[1] NSS of AR – yearbooks 2000-2006,2006-2009,2009-2014,2019,2020. pages 118,175,171-172,203-204,212-213, http://stat-nkr.am/files/yearbooks/2000_2006/15.pdf, http://stat-nkr.am/files/yearbooks/2003_2009/19_Prom_161-181.pdf, http://stat-nkr.am/files/yearbooks/2008-2014/19_Prommet_159-160.pdf, http://stat-nkr.am/files/yearbooks/2019/14_Prommet_189-205.pdf, http://stat-nkr.am/files/publications/2020/Taregirq/14%20ardyunaberutyun.pdf. The Central Bank of the NKR – "Archive of exchange rates", 2000-2019, https://www.cba.am/am/SitePages/statexternalsector.aspx

Table 3. 2000-2019 electricity export, import and exchange rate of electricity (1 Rub. compared to dram) in the NKR[1]

Year	Exchange rate (1 Rub. compared to dram)	Electricity import (million kWh)	Electricity export (million kWh)
2000	19.05	117.4	5.5
2001	18.97	122.2	12.5
2002	18.24	72	33.3
2003	18.83	68.9	44
2004	18.52	77.3	44.6
2005	16.19	115.7	17.7
2006	15.29	154	3.4
2007	13.37	145.2	10.1
2008	12.35	132.7	5.7
2009	11.5	134.8	25.5
2010	12.32	96.3	41
2011	12.7	153.2	15.7
2012	12.94	118	18.8
2013	12.88	87.2	11
2014	10.98	78.1	14.4
2015	7.89	87.7	16.2
2016	7.19	31.6	29
2017	8.28	50.8	27.5
2018	7.73	34.9	52.2
2019	7.43	15.1	10.1

In order to identify the relationship between the volume of industrial production, electricity production, electricity consumption, export and import of electricity in the real sector of the NKR economy, the following indicators were considered and evaluated (Table 4).

[1] NSS of AR – yearbooks 2000-2006, 2006-2009, 2009-2014, 2019, 2020. pages 118,175,171-172,203-204,212-213, http://stat-nkr.am/files/yearbooks/2000_2006/15.pdf, http://stat-nkr.am/files/yearbooks/2003_2009/19_Prom_161-181.pdf, http://stat-nkr.am/files/yearbooks/2008-2014/19_Prommet_159-160.pdf, http://stat-nkr.am/files/yearbooks/2019/14_Prommet_189-205.pdf, http://stat-nkr.am/files/publications/2020/Taregirq/14%20ardyunaberutyun.pdf. The Central Bank of the Republic of Artsakh – "Archive of exchange rates", 2000-2019., https://www.cba.am/am/SitePages/statexternalsector.aspx

Table 4. 2000-2019 volume of industrial production, electricity production, electricity consumption, electricity export and electricity import in NKR[1]

Year	Volume of industrial production (million drams)	Electricity production (million kWh)	Electricity consumption (million kWh)	Electricity export (million kWh)	Electricity import (million kWh)
2000	4854.6	43.1	155	5.5	117.4
2001	5903.8	51.4	151.1	12.5	122.2
2002	8082.6	108.6	147.3	33.3	72
2003	11125.4	130.6	155.5	44	68.9
2004	18579.1	137	169.7	44.6	77.3
2005	17773	112.1	210.1	17.7	115.7
2006	24203.6	69.1	219.7	3.4	154
2007	22437.4	90.4	225.5	10.1	145.2
2008	25345.5	97.1	224.1	5.7	132.7
2009	34092.3	119.2	228.5	25.5	134.8
2010	42991.8	177.6	232.7	41	96.3
2011	45822.5	121.9	259.4	15.7	153.2
2012	40871.7	164.5	263.7	18.8	118
2013	44339.4	193.2	269.4	11	87.2
2014	52046.8	224.5	288.2	14.4	78.1
2015	53541.3	221.3	292.8	16.2	87.7
2016	58999.5	296.5	299.1	29	31.6
2017	97490.3	327.8	351.1	27.5	50.8
2018	125006.1	388.6	371.4	52.2	34.9
2019	164856.2	479.3	393.6	10.1	15.1

As a result, the impact of electricity generation, consumption, export and import on industrial output was assessed. On these grounds, a regression equation was developed calculated for individual indicators characterizing the industry of the AR:

$$Y=a_0+a_1EA+a_2ES+a_3EX+a_4IM+\varepsilon_t\,, \quad (1)$$

where

Y is the value of the volume of industrial output (million dram),
EA is the production of electricity (million kWh),
ES is electricity consumption (million kWh),
EX is electricity export (million kWh),
IM is electricity import (million kWh),
a_0, a_1, a_2, a_3, a_4 are independent coefficients of variable flexibility,
ε_t is the value of the random error.

For the calculation, the annual official statistical data of the volume of industrial production, electricity production, electricity consumption, electricity export, electricity import indices for 2000-2019 were considered.

[1] NSS of AR – yearbooks 2000-2006, 2006-2009, 2009-2014, 2019, 2020. pages 118, 175, 171-172, 203-204, 212-213, http://stat-nkr.am/files/yearbooks/2000_2006/15.pdf, http://stat-nkr.am/files/yearbooks/2003_2009/19_Prom_161-181.pdf, http://stat-nkr.am/files/yearbooks/2008-2014/19_Prommet_159-160.pdf, http://stat-nkr.am/files/yearbooks/2019/14_Prommet_189-205.pdf, http://stat-nkr.am/files/publications/2020/Taregirq/14%20ardyunaberutyun.pdf. NSS of AR, http://stat-nkr.am/hy/component/content/article/763-2017-11-02-13-10-04

(1) in the economic model, the statistical series are 19, which means that the values obtained are almost close to reality. It was evaluated by the method of smaller squares using the Eviews 9 computer program[1], according to which the corresponding regression and correlation analysis was carried out.

It should be noted that before estimating the model, it is necessary to equalize the data, therefore, the data have been logarithmized (see Table 5) for this purpose to avoid obtaining a false multifactorial linear regression.

Table 5. Logarithm values of the 2000-2019 volume of industrial production, electricity production, electricity consumption, electricity export and electricity import in the NKR[2]

Year	Electricity production (million kWh)	Electricity import (million kWh)	Electricity export (million kWh)	Electricity consumption (million kWh)	Electricity losses (million kWh)	Electricity rate (AMD)
2000	43.1	117.4	5.5	155	68.8	14
2001	51.4	122.2	12.5	151.1	61	14.1
2002	108.6	72	33.3	147.3	54.5	14
2003	130.6	68.9	44	155.5	48.4	14
2004	137	77.3	44.6	169.7	46.6	14
2005	112.1	115.7	17.7	210.1	65.9	14
2006	69.1	154	3.4	219.7	61.1	16.8
2007	90.4	145.2	10.1	225.5	53.3	20
2008	97.1	132.7	5.7	224.1	45.2	20
2009	119.2	134.8	25.5	228.5	42.6	23.3
2010	177.6	96.3	41	232.7	39.5	25
2011	121.9	153.2	15.7	259.4	44.5	25
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2013	193.2	87.2	11	269.4	42.3	25
2014	224.5	78.1	14.4	288.2	45.3	25
2015	221.3	87.7	16.2	292.8	47.5	25
2016	296.5	31.6	29	299.1	45.9	25
2017	327.8	50.8	27.5	351.1	56.8	25
2018	388.6	34.9	52.2	371.4	41.7	25
2019	479.3	15.1	10.1	393.6	43.4	25

A correlation analysis was carried out in the work, according to which the degree of accuracy of the selected factors and the indicator of industrial production was revealed. Moreover, both significant positive and negative correlations were found between the observed factors (Table 6).

Thus, the analyses justify that there is a significant positive correlation between the following factors:

- A change in one percentage point of electricity production leads to an increase of 0.89 percentage points in industrial output;
- A change in one percentage point of electricity consumption leads to an increase of 0.96 percentage points in industrial output;
- A change in one percentage point of electricity exports leads to an increase of 0.19 percentage points in industrial output.

In addition, a significant negative correlation was received from the observed indicators, in particular:

- between electricity import and industrial products: 0.57;
- between electricity import and electricity production: 0.79;
- between electricity import and electricity consumption: 0.54.

[1] Eviews is the Windows version for the Micro TSP package, which, in fact, is a guide to econometric methods, http://www.eviews.com/.

[2] Calculated by the author based on the statistic data of NSS of AR.

Consequently, the results of the carried out correlation analysis confirm that there is a significant relationship between the factors under consideration and the volume of industrial production.

Table 6. Correlation values between the selected factors[1]

	Y	EA	ES	EX	IM
Y	1.000000				
EA	0.894969	1.000000			
ES	0.969550	0.839493	1.000000		
EX	0.192062	0.473196	0.048146	1.000000	
IM	-0.571728	-0.794858	-0.546834	-0.364008	1.000000

The results obtained as a result of the regression model evaluation are shown in Table 7, where the coefficients of independent variables are a_0, a_1, a_2, a_3, a_4, a_5. And the t – statistic and Prob(t)[2] show that the estimated coefficients in the model are statistically significant at the significance level of 1% $|t|>t_{crit.}$ for all estimated coefficients (|-4.25|>1.75, |2.13|>1.75, |4.74|>1.75, |1.76|>1.75)[3]:

F statistic and Prob(F) indicate that the equation is statistically significant at the significance level of 1% ($F > F_{crit.}$, F = 122.6 and $F_{crit.}$ = 3.287). The hypothesis $H_0: \beta_1 = \beta_2 = \ldots = \beta_{p-1} = 0$ was rejected in the model at the significance level of 1%[4].

From the results of Table 7, it can be concluded that there is a significant relationship between the factors under consideration and the volume of industrial production. The adjusted coefficient of determination is 0.96, that is, 96% of the variation of the dependent (the size of industrial production) variable is explained by the variables included in the regression model, and the remaining 4% by random errors[5].

Table 7. Model evaluation results[6]

Sample: 2000 2019
Included observations: 20
Y=C(1)+C(2)*EA+C(3)*ES+C(4)*EX+C(5)*IM

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-5.946567	1.396932	-4.256876	0.0007
C(2)	0.656349	0.307686	2.133182	0.0498
C(3)	2.177136	0.458784	4.745453	0.0003
C(4)	0.009068	0.104260	0.086971	0.9318
C(5)	0.244973	0.139532	1.755676	0.0995
R-squared	0.970316	Mean dependent var		10.32398
Adjusted R-squared	0.962401	S.D. dependent var		0.954783
S.E. of regression	0.185138	Akaike info criterion		-0.323117
Sum squared resid	0.514139	Schwarz criterion		-0.074184
Log likelihood	8.231173	Hannan-Quinn criter.		-0.274523
F-statistic	122.5823	Durbin-Watson stat		1.582076
Prob(F-statistic)	0.000000			

[1] Calculated by the author.
[2] Елисеева И. И. Эконометрика, М., 2009, с. 25-28.
[3] Магнус Я. Р., Катышев П. К., Пересецкий А. А., Эконометрика. Начальный курс: Издательство "ДЕЛО" Москва, 2004, с. 67,
[4] In case of n=20, p=4, α=0.05 significance level in the model v= 0.95, k_1=3, k_2=16, the searched critical value of a random value with a Fisher distribution F_{crit} = 3.24.
[5] Магнус Я. Р., Катышев П. К., Пересецкий А. А., Эконометрика. Начальный курс: Издательство "ДЕЛО" Москва, 2004, с. 67.
[6] Calculated by the author.

Thus, (1) the calculated values of the econometric model are reflected in the model (2):

$$Y= -5.946567+ 0.656349EA + 2.177136ES – 0.009068EX + 0.244973IM + \varepsilon_t \quad (2)$$

Thus, as a result of the application of the econometric model and mathematical tools in the work, the model (2) was calculated, and its economic values were justified:

1. A one percentage point change in electricity production (EA) leads to an increase in industrial output (Y) by 0.65 percentage points.
2. A change in one percentage point of electricity consumption (ES) leads to an increase in the volume of industrial output (Y) by 2.17 percentage points.
3. A change of one percentage point of electricity exports (EX) reduces the volume of industrial output (Y) by 0.01 points.
4. A change in one percentage point of electricity imports leads to an increase in the volume of industrial products (Y) by 0.24 percentage points.

Summing up, it should be noted that:

1. changes in the volume of production, consumption, export and import of electricity are caused by electricity tariffs;
2. the change in the exchange rate for a certain period has increased the export of electricity conditioned by the exchange rate, but has reduced the import of electricity conditioned by the exchange rate, and for a certain period the opposite. As a result, the downward trend in exports was caused by fluctuations in exchange rates in AMD/dollar, as well as in AMD/ruble;
3. electricity production, electricity consumption and electricity imports have a positive impact on the volume of industrial output, while only electricity exports have a negative impact, due to the fact that the sectors of the NKR economy are not involved on the entire scale.

In addition, the work assessed the scale of the shadow economy of the NKR by the method of electricity consumption (Kaufmann-Calibardi method of electricity consumption), for which the assertion that the dynamics of electricity consumption in this country corresponds to the dynamics of overall economic activity was accepted. Consequently, over the years, differences in the rates of change in electricity consumption and real GDP volumes show the size of the shadow economy. After studying the changes in the presented indicators, Kaufmann and Calibardi suggested the following equation:

$$\varepsilon_t = \frac{e_0}{gdp_0} = \frac{e_1}{gdp_1} = \cdots = \frac{e_n}{gdp_n} \approx 1 \quad (3)[1]$$

where

ε_t is the elasticity of electricity consumption in the t[th] by GDP,

e_0 is the change (increase or decrease) in the overall level of electricity consumption compared to last year,

gdp is the change in GDP compared to last year.

Based on the Kaufmann-Calibardi method, the coefficients of flexibility of electricity consumption by GDP were estimated in the work, showing the causes of the shadow occurrence in the Republic of Artsakh depending on the volume of electricity. Accordingly, the annual statistics of electricity consumption and real GDP for 2000-2019 were reviewed, and the results of the calculation are presented in Table 8.

[1] Schneider Friedrich, Buehn Andreas, "Shadow Economy: Estimation Methods, Problems, Results and Open questions", published by De Gruyter Open, February 28, 2017, p. 10

Table 8. Indicators characterizing the size of the shadow economy in the AR in terms of electricity consumption and real GDP growth rates (according to the Kaufmann-Calibardi method)[1]

Year	Electricity consumption growth rate (%)	Real GDP growth rate (%)	Elasticity of electricity consumption by GDP (%)
2001 compared to 2000	-0.19	106.7	-0.002
2002 compared to 2001	-0.18	102.5	-0.002
2003 compared to 2002	0.4	111.3	0.004
2004 compared to 2003	0.7	120.2	0.006
2005 compared to 2004	2.01	118.2	0.02
2006 compared to 2005	0.47	114.1	0.004
2007 compared to 2006	0.28	110.1	0.003
2008 compared to 2007	-0.07	108.8	-0.001
2009 compared to 2008	0.22	114.3	0.002
2010 compared to 2009	0.21	113.1	0.002
2011 compared to 2010	1.33	105.5	0.013
2012 compared to 2011	0.21	109.1	0.002
2013 compared to 2012	0.28	109.9	0.003
2014 compared to 2013	0.93	109.3	0.01
2015 compared to 2014	0.23	108.9	0.002
2016 compared to 2015	0.31	109.1	0.003
2017 compared to 2016	2.58	109.2	0.024
2018 compared to 2017	1.01	115.6	0.009
2019 compared to 2018	1.1	111.9	0.01

According to which, the elasticity of electricity consumption according to the calculation of GDP were:

- 2001 compared to 2000: -0.002<1,
- 2002 compared to 2001: -0.002<1,
- 2003 compared to 2002: 0.004<1,
- 2004 compared to 2003: 0.006<1,
- 2005 compared to 2004: 0.02<1,
- 2006 compared to 2005: 0.004<1,
- 2007 compared to 2006: 0.003<1,
- 2008 compared to 2007: -0.001<1,
- 2009 compared to 2008: 0.002<1,
- 2010 compared to 2009: 0.002<1,
- 2011 compared to 2010-0.0135<1,
- 2012 compared to 2011: 0.002<1,
- 2013 compared to 2012: 0.003<1,
- 2014 compared to 2013: 0.01<1,
- 2015 compared to 2014: 0.002<1,
- 2016 compared to 2015: 0.003<1,
- 2017 compared to 2016: 0.024<1,
- 2018 compared to 2017: 0.009<1,
- 2019 compared to 2018: 0.01<1.

[1] Calculations were made by the author.

As a result, it should be noted that if the results obtained are equal to 1, this is due to the fact that the more electricity consumption increases, the more GDP should increase, but the results obtained are not equal to 1 (they are bigger or less than 1), therefore, there is a shadow in those years.

Table 9. Rates of electricity consumption, real GDP and production volume growth rates in the AR (%) [1]

Year	Electricity consumption growth rate (%)	Real GDP growth rate (%)	Elasticity of electricity consumption by GDP (%)
2001 compared to 2000	-0.19	106.7	19.26
2002 compared to 2001	-0.18	102.5	111.3
2003 compared to 2002	0.4	111.3	20.26
2004 compared to 2003	0.7	120.2	4.901
2005 compared to 2004	2.01	118.2	-18.17
2006 compared to 2005	0.47	114.1	-38.36
2007 compared to 2006	0.28	110.1	30.83
2008 compared to 2007	-0.07	108.8	7.412
2009 compared to 2008	0.22	114.3	22.76
2010 compared to 2009	0.21	113.1	48.99
2011 compared to 2010	1.33	105.5	-31.36
2012 compared to 2011	0.21	109.1	34.95
2013 compared to 2012	0.28	109.9	17.45
2014 compared to 2013	0.93	109.3	16.20
2015 compared to 2014	0.23	108.9	-1.425
2016 compared to 2015	0.31	109.1	33.98
2017 compared to 2016	2.58	109.2	10.56
2018 compared to 2017	1.01	115.6	18.55
2019 compared to 2018	1.1	111.9	23.34

According to Table 9, in 2001, compared with 2000, the growth rates of electricity consumption, production and real GDP amounted to -0.19%, 19.26% and 106.7%, but in 2005 compared to 2004 amounted to 2.01%, 118.2% and -18.17%. The picture was different in 2017 compared to 2016, as the real growth rates of production, electricity consumption and GDP increased to 2.58%, 109.2% and 10.56%. Therefore, it should be noted that in the period under review, the existence of a shadow economy was revealed as a result of changes in electricity consumption, production volume and real GDP growth rates.

Thus, based on the factors determining the changes in the volume of electricity consumption, the size of the shadow economy was revealed according to the Kaufmann-Calibardi method. According to which, the fact that the coefficients of electricity consumption elasticity (in terms of real GDP) in the Artsakh Republic are higher or lower is explained by the existence of a shadow economy. In particular, comparing with the production volumes, it was grounded that the economic preconditions for production in the AR are uncompetitive, which leads to the formation of informal incomes, informal employment, and in terms of electricity consumption, it brings to the emergence of a gap with respect to the real GDP growth, which in its turn is explained by the existence of a shadow economy. Accordingly, it is proposed to implement infrastructure reforms aimed at reviewing electricity tariffs, creating alternative energy, reducing the shadow economy in that field, which can further increase the income of the population and improve living standards.

[1] Figure 6 is compiled by the author on the basis of statistical data of the NSS AR website.

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