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ECONOMETRIC MODELING OF ELECTRICITY CONSUMPTION BY HOUSEHOLDS AS A TOOL FOR THE CALCULATING OF THE SOCIAL CONSUMPTION NORM[1]

Since July 2016, it is planned to introduce electricity tariffs with the social consumption norm in all regions of Russia. The methodology for calculation the electricity social consumption norm for different types of households was legally adopted by resolutions of the Government of the Russian Federation. According to these regulations, at least 70 % of the actual volume of electric power supply to the population should fall within the social norm. This article analyzes the validity of the methodology for calculating the social norm. The research is based on the data about the consumption of electricity by Russian households. The purpose of this study is to construct an econometric model of electricity consumption and calculate model-based social norms for different types of households. Explanatory variables in the model are the factors that describe the household size and accommodation conditions: the number of residents, the presence or absence of electric cooker, the type of settlement (urban or rural), the climate of the region where the household lives. The simulation results show that 70 % of electricity will be consumed within the social norms, if the size of the norm for households consisting of one person, will be from 110 to 210 kW·h, depending on the accommodation conditions. The author also evaluates the necessary social norm increments for the second, third and subsequent members of different household types. The developed model takes into account the regional characteristics of energy consumption and can be useful for calculating the social norm of electricity consumption in the regions of Russian Federation.

Keywords: social norm of electricity consumption, econometric model, electricity, electricity demand, cross-subsidies, electricity tariffs, power conservation, energy efficiency, energy consumption, household

Introduction

Experiment on the introduction of two-part tariffs with the social norm of electricity consumption was launched on September 1, 2013 at six pilot regions of the Russian Federation. The population pays for the electricity consumed within the social norm, social reduced rate, and for the electricity over the social norm — increased cost-based tariffs.

The experiment takes place in Vladimir, Nizhny Novgorod, Orel, Rostov regions, as well as the Trans-Baikal and Krasnoyarsk territories. The procedure for calculating the social norm of electricity consumption in these areas is regulated by the Government of the Russian Federation (RF) decree on July 22, 2013 № 614[2]. The size of the social norm in the pilot regions varies significantly, from 50 kW·h in Nizhny Novgorod and Vladimir regions up to 190 kW·h in the Orel region per person (at first member of household).

If the experiment would succeed, the government planned to introduce a new procedure for calculating the payment of electricity throughout the country from July 1, 2014. However, the practice of two-part tariffs with a social norm in the pilot regions shows the imperfection of their calculation methodology, so the decree of the RF Government dated by February 25, 2014 № 136[3] has postponed the project until July 2016. This decree has adjusted the methodology for calculating the social norm.

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[1] Original Russian Text © Zaitseva Yu. V., 2016, published in Ekonomika regiona [Economy of Region]. — 2016. — Vol. 12, Issue 2. — 405–416.

[2] O poryadke ustanovleniya i primeneniya sotsialnoy normy potrebleniya elektricheskoy energii (moshchnosti) i o vnesenii izmeneniy v nekotoryye akty Pravitelstva Rossiyskoy Federatsii po voprosam ustanovleniya i primeneniya sotsialnoy normy potrebleniya elektricheskoy energii (moshchnosti). Postanovlenie Pravitelstva RF № 614 ot 22.07.2013 g. [On the procedure for the establishment and application of the social norms of consumption of electric energy (power) and on amendments to certain acts of the Government of the Russian Federation on the establishment and application of the social norms of electricity consumption (power). Decree of the Government of the Russian Federation №614 on July 22, 2013]. Available at the reference-legal system "Garant" (date of access: 07.03.2015).

[3] O vnesenii izmeneniy v nekotorye akty pravitelstva Rossiyskoy Federatsii po voprosam ustanovleniya i primeneniya sotsialnoy normy potrebleniya elektricheskoy energii (moshchnosti). Postanovlenie Pravitelstva RF № 136 ot 25.02.2014 g. [On amendments to some acts of the Government of the Russian Federation on the establishment and application of social norms of consumption of electric energy

One of the objectives of the social norms introduction is a slowdown in electricity tariffs for the poor, the least socially protected strata of the population. An equally important goal is to encourage energy conservation and energy efficiency. It is expected that households will use the energy more economically to keep within the social norm.

In addition, innovation will help reduce the amount of cross-subsidization. Excessive costs for electricity incurred by the industry have a negative impact on the economic performance of enterprises and reduce their competitiveness. Companies add their energy costs to total costs of products, and consumers buy products at inflated prices ultimately. It should be noted, the more a person consumes, the greater amount of hidden subsidies he/she receives under the current system of cross-subsidization. At the same time, as a rule, wealthy households with the ability to pay for utility bills in full cost consume large amounts of electricity, and vice versa — poor households consume little.

A significant number of studies by both Russian [1–5] and foreign [6–10] researchers are devoted to the problem of calculating the reasonable size of social norm and estimation of its introduction effect. Many countries have long practiced tariffs with a consumption social norm to support poor households and encourage energy conservation. Thus, the tariffs with the social norm of electricity consumption are used since 2000 in France. Families with low incomes have a discount of 30 % to 50 % on electricity costs within 100 kW·h per month. Multi-part tariffs with higher rates designed to reduce the burden on commercial and industrial customers, set in India. Social norms in India are different from state to state and even within states, taking into account regional specificities [3]. In Colombia, all households are divided into six categories depending on the characteristics of the building and housing quality. Multi-part tariff with a social norm of consumption is designed for every single category. As a result, the poorest households receive transfers at a rate of about 5 % of their total income. Moreover, they get this transfer not from the budget but from the most wealthy households, who lose only 1 % of their income according to the authors [10].

The social consumption norm of electricity will be introduced throughout the Russian Federation. In this connection, it is relevant to check the validity of the methodology for calculating the social norm, proposed in the Government Decrees № 614 and № 136, by means of statistical analysis of data on the electricity consumption by households of the Russian Federation.

The objective of this study — is to construct of an econometric model of electricity consumption by the Russian households and calculate model-based social norms for different types of households.

The econometric models of the demand for electricity by households were studied in both foreign and domestic authors [11–13]. The researchers include a different set of explanatory variables in the models, depending on the purpose of the study. So in the article [11], the author explores the dependence of energy consumption by households of the Russian Federation on the price and per capita income. The study [12] investigates a similar dependence for California households. In the article [13], the authors add to the model factors that characterize the presence, number and the capacity of electrical appliances.

In this study, we develop a model for reasonably estimating the social norm. Therefore, the explanatory variables describe the size and conditions of households living: the number of residents, the presence or absence of electric cooker, the type of settlement (urban or rural), the climate of the region where the household lives.

The model takes into account regional characteristics of electricity consumption and allows calculating the social norms, which do not discriminate residents living in regions with severe climatic conditions. The model also allows taking into consideration the interests of large families with minor children.

The methodology for calculating the social consumption norms, regulated by Decrees of the RF Government

According to the decrees, the authorized body of the state authority of the Russian Federation carries out the calculation of social norms based on the sample data on the annual electricity consumption in the previous year. The sample consists of at least 10,000 people living in the urban areas in dwellings are not equipped in the prescribed manner by the stationary electric cookers.

(power). Decree of the Government of the Russian Federation № 136 on February 25, 2014]. Available at the reference-legal system "Garant" (date of access: 03.07.2015).

First, it is necessary to compute the base value for calculating the social norm as the average consumption of a person living alone (the household of the first group) in urban areas in a dwelling, not equipped with electric cookers and electric space and water heaters. The base value of the social norm is calculated by the formula

$$V_{SN,urban} = \frac{V_{urban}}{12 \times P_{urban}}, \tag{1}$$

where V_{urban} — volume of actual annual consumption of electricity by households represented in the sample, in the past year; P_{urban} — the number of people registered in these households.

Further, the social norm is calculated for the six groups of households and six types of dwellings. All households are divided into six groups according to the number registered in the dwelling. The group number corresponds to the number registered persons in the household for the first, second, third and fourth groups. For example, the third group includes households with three registered persons. The fifth group includes households with five or more registered persons. The sixth group includes households of citizens living in the dwellings of specialized housing, where they are not combined joint housekeeping.

Dwellings are divided into types depending on the presence or absence of electric cookers and electric space and water heaters, as well as, depending on the place of residence (urban or rural).

The value of the social norm for the first group of households living in dwellings in urban areas and not equipped in the prescribed manner by electric cookers and electric space and water heaters, is calculated by the formula:

$$SN^1 = D \times V_{SN,\,urban}, \tag{2}$$

where D — coefficient taking values: D = 1,5 — for households in an emergency or dilapidated housing stock with a degree of the wear more than 70 %; D = 1 — for other households.

The value of the social norm for groups of households in the second through fifth in dwellings located in urban areas and are not equipped in the prescribed manner by stationary electric cookers and electric space and water heaters, is calculated by the formula

$$SN^n = SN^{n\text{-}1} + D \times R^n, \tag{3}$$

where n — the number of persons registered in a dwelling in the prescribed manner (n = 2, 3, 4, 5); R^n — the increment of the social norm for n-th household member.

According to the decree № 614, R^n coefficient was set 50 kW·h for n = 2 and 20 kW·h for n = 3, 4 or 5. Decree № 136 amended to R^n coefficient: 60 kW·h per month for n = 2 and 40 kW·h for n = 3, 4 or 5.

The value of the social norm for dwellings located in rural areas that are not equipped in the prescribed manner by stationary electric cookers and electric space and water heaters, is calculated by the formula

$$SN^n_{rural} = SN^n + SN_{rural}, \tag{4}$$

where: SN_{rural} — quantity characterizing the specifics of the electricity consumption in rural areas. This value is set by the authorized body of state authority of the Russian Federation of not more than 100 kW·h per month per household.

The value of the social norm for dwellings equipped in the prescribed manner by stationary electric cookers and (or) electric space and water heaters, is calculated by the formula

$$SN^n_{EC} = SN^n + \Delta SN^n_{EC}, \tag{5}$$

where ΔSN^n_{EC} — quantity characterizing the electricity consumption for cooking and (or) heating using a stationary electric cookers and (or) electric space and water heaters with the appropriate number of duly registered persons. The value ΔSN^n_{EC} is set by the authorized body of the state authority of the Russian Federation in the amount of not more than 50 kW·h per month per person, but not less than 90 kW·h per month per household.

After calculating the social norms for all categories of consumers, the authorized body of the state power of the Russian Federation, if necessary, adjusts the social norms so that the scope of delivery within the social norms was a share of not less than 70 % and not more than 85 % of the actual amount of electricity supplied to the population.

The data for the econometric model

The econometric model is based on the data from the Russian Longitudinal Monitoring Survey (RLMS-HSE) conducted by National Research University "Higher School of Economics" and ZAO "Demoscope" together with Carolina Population Center, the University of North Carolina at Chapel Hill and the Institute of Sociology RAS[4]. The monitoring is a series of annual nationally representative surveys based on a stratified random multistage area sampling, developed with the participation of the world's leading experts in this field. Since 2010, the RLMS-HSE data is available for researchers in Russia and abroad.

We use data 22nd waves for research (the survey was conducted in December 2013). We analyze the following indicators on the 4763 Russian households: the number of residents, the average monthly electricity consumption, the presence or absence of electric cooker, type of settlement (urban or rural),

[4] Rossiyskiy monitoring ekonomicheskogo polozheniya i zdorovya naseleniya NIU-VShE (RLMS-HSE). [Russian Longitudinal Monitoring Survey (RLMS-HSE)]. Retrieved from: http://www.hse.ru/rlms (date of access: 03.07.2015).

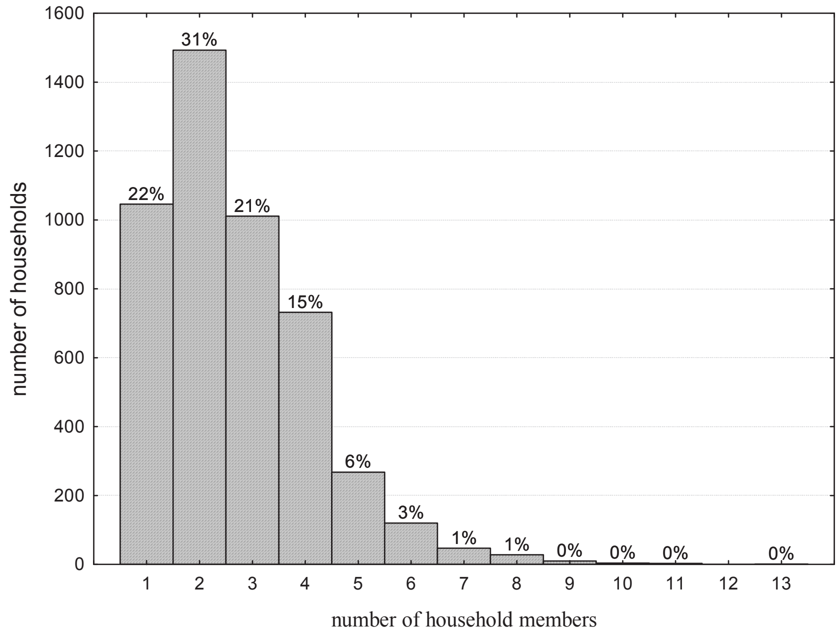

Fig. 1. *Frequency histogram of the number of household members*

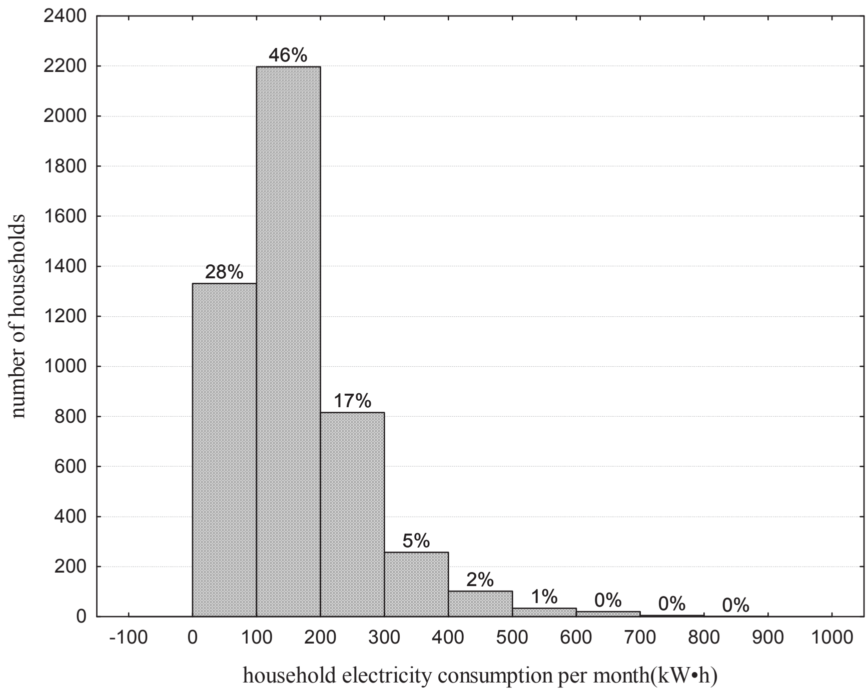

Fig. 2. *Frequency histogram of the household electricity consumption per month*

the climatic conditions of the region where the household lives. We divide regions represented in the sample, into 3 groups according to the climatic conditions: cold, temperate and warm climates, using the division of the territory of Russia in temperature zones[5]. The regions of the I and II zones are assigned to the regions with a warm climate, the regions of the II and III zones — to the regions with temperate climate and regions of the V and VI areas — to the regions with cold climate. The author has presented some preliminary results of the statistical analysis previously [2].

About 72 % of all households in the sample live in urban areas. Most households (65 %) live in areas with a temperate climate, 20 % — in cold regions, and 15 % — in regions with a warm climate. Approximately 21 % of households use the stationary electric cooker.

Most of the households represented in the sample (31 %), consist of two members. Approximately equal shares — 22 % and 21 % — are households consisting of one person and three persons respectively. Households consisting of four members make up 15 % of all households. A further 6 % are the household of five residents. The households of six persons or more are 5 % of all households in the sample (Fig. 1).

An analysis of the frequency histogram of the household electricity consumption per month (Fig. 2) shows that most of households (46 %) consume from 100 to 200 kW·h of electricity per month, 28 % of households use 100 kW·h per month, 17 % of households consume from 200 to 300 kW·h per month. More than 300 kW·h of electricity per month consume 9 % of households.

Econometric modeling of electricity consumption by households

We have developed an econometric model for the calculating the reasonable social norm of energy consumption for the different types of households. The dependent variable of the model is the household electricity consumption per month *Q*. Explanatory variables are: the number of household members *N*, the type of settlement (urban or rural), climatic conditions, the presence or absence of electric cooker in the household. Let us introduce dummy variables [14, p. 100–105] for qualitative factors. For the type of settlement:

$$status = \begin{cases} 1, & if \ \ household \ \ lives \ \ in \ \ rural, \\ 0, & if \ \ household \ \ lives \ \ in \ \ urban. \end{cases} \quad (6)$$

For the presence or absence of electric cooker:

$$plita = \begin{cases} 1, & if \ household \ has \ \ electric \ \ cooker, \\ 0, & if \ household \ hasn't \ \ electric \ \ cooker. \end{cases} \quad (7)$$

Since climatic conditions include three levels, two dummy variables are introduced for this factor:

$$climat\_um = \begin{cases} 1, & if \ climate \ \ is \ temperate, \\ 0, & if \ climate \ \ isn't \ temperate; \end{cases} \quad (8)$$

$$climat\_cold = \begin{cases} 1, & if \ climate \ \ is \ cold, \\ 0, & if \ climate \ \ isn't \ cold. \end{cases} \quad (9)$$

Table 1 presents the possible values of dummy variables *climat_um* and *climat_cold* for households living in the different climatic conditions.

Table 1

The values of dummy variables for households in regions with different types of climate

The values of dummy variables	Type of climate of the region where the household lives		
	warm	temperate	cold
climat_um	0	1	0
climat_cold	0	0	1

Source: constructed by the author.

The linear function is not suitable for modeling household electricity consumption, depending on the number of its members, because the increment of electricity consumption by the household with increasing household size for one person is not constant. The more members of the household are, the

[5] Prilozhenie k sborniku smetnykh norm dopolnitelnykh zatrat pri proizvodstve stroitelno-montazhnykh rabot v zimnee vremya [The application for the collection of the estimated additional cost standards in the production of construction and installation works in the winter]. Available at the legal advisory service "Zakon prost" (date of access: 07.03.2015).

less increment is. Therefore, the dependence of electricity consumption by the number of household members must be modeled by a nonlinear, convex function. For example, it may be a logarithmic function and a power function with an exponent less than one. Frequency histogram of the household electricity consumption *Q* (Fig. 2) indicates a similarity with the lognormal distribution. Therefore, before constructing model, we transform the dependent variable by taking its logarithm and use a suitable power function for modeling of electricity consumption by the household of the number of residents.

Thus, we select the following specification of the econometric model

$$\ln(Q) = a_0 + a_1 \ln(N) + a_2 status + a_3 plita + a_4 climat\_um + a_5 climat\_cold. \tag{10}$$

After exponentiation model looks

$$Q = e^{a_0} N^{a_1} e^{a_2 status} e^{a_3 plita} e^{a_4 climat\_um} e^{a_5 climat\_cold}. \tag{11}$$

The regression results are represented in Table 2.

Table 2

Estimated regression with all factors

Variable	Coefficient	Standard Error	*t*-Statistic	*p*-value
constant	4,51	0,021	214,02	0,00
plita	0,34	0,017	20,06	0,00
climat_um	–0,03	0,019	–1,85	0,06
climat_cold	0,13	0,023	5,71	0,00
status	0,13	0,015	8,75	0,00
ln(*N*)	0,49	0,012	42,54	0,00

Source: constructed by the author.

The coefficient of the dummy variable *climat_um* is not significant (at a significance level of 0.06 or less). This means that the electricity consumption of households living in a temperate and warm climate is the same (all other factors being equal). Variable *climat_um* was excluded from the model. The regression results after excluding dummy variable *climat_um* are represented in Table 3.

Table 3

Estimated regression after excluding non-significant factor

Variable	Coefficient	Standard Error	t-Statistic	p-value
constant	4,47	0,013	347,80	0,00
plita	0,34	0,017	19,97	0,00
climat_cold	0,16	0,017	9,53	0,00
status	0,13	0,014	9,14	0,00
ln(*N*)	0,50	0,016	43,05	0,00

Source: constructed by the author.

All coefficients in the model are significant. The *F*-test of overall significance is $F = 656{,}83$, *p*-level for it almost equals to zero, which means that the model is significant. The coefficient of determination for the model is $R^2 = 0{,}36$, the multiple correlation coefficient is $R = 0{,}6$. The coefficient of determination is quite low: only 36 % of the variation in the logarithm of the dependent variable can be explained by the factors included in the model. The electricity consumption depends on a number of other factors. However, for reasonably estimating social norms we are interested in the factors included in the model.

Histogram (Fig. 3) illustrates an approximately normal distribution of residuals produced by a model.

Thus, the conclusion about the overall and individual factors significance is correct. In addition, the normal distribution of the residuals enables us to construct 70-percent quantile for the electricity consumption and, therefore, calculate the reasonable social norms for different types of households.

So, the constructed econometric model is

$$\ln(Q) = 4{,}47 + 0{,}50 \cdot \ln(N) + 0{,}13 \cdot status + 0{,}34 \cdot plita + 0{,}16 \cdot climat\_cold, \tag{12}$$

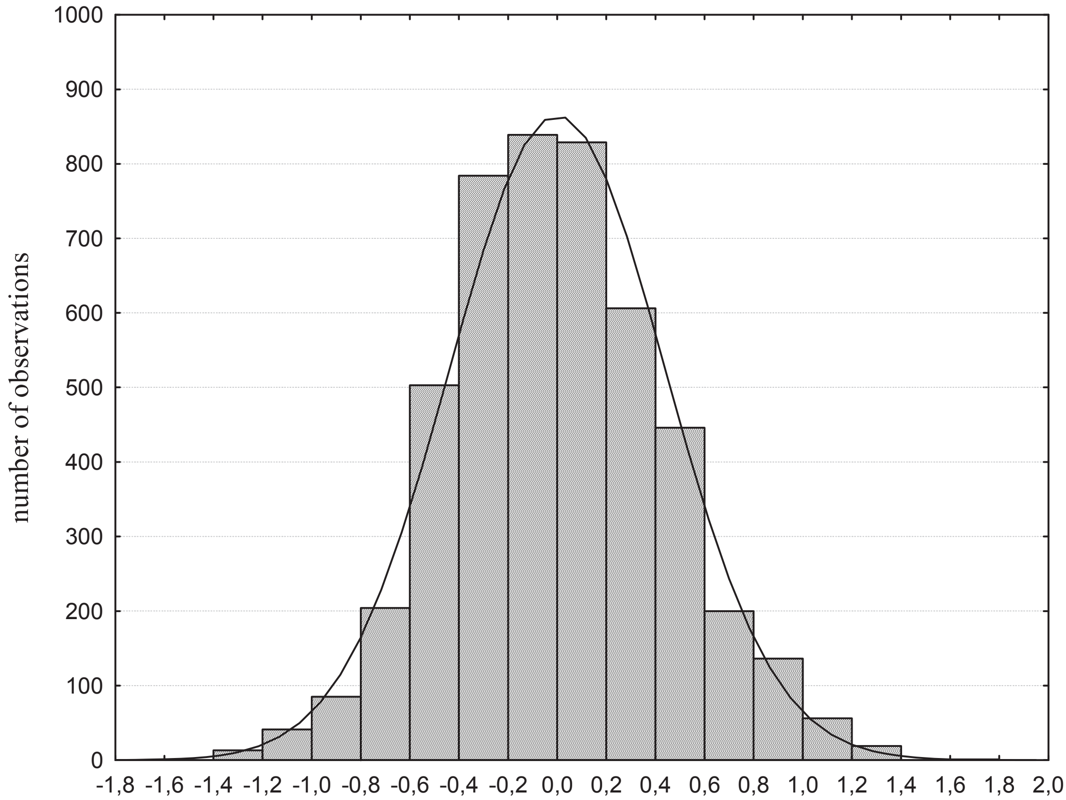

Fig. 3. *Histogram of residuals from regression model*

or after exponentiation:

$$Q = 87{,}75 N^{0{,}5} e^{0{,}13 \cdot status} e^{0{,}34 \cdot plita} e^{0{,}16 \cdot climat\_cold}. \quad (13)$$

The predicted electricity consumption of urban households without an electric cooker, living in a warm climate, and consisting of a single person is equal to 88 kW·h. For households in rural areas, the predicted electricity consumption is $e^{0{,}13} \approx 1{,}14$ times higher than in the urban areas. Thus, rural households consume an average of 14 % more electricity, ceteris paribus, than urban. Households living in dwellings equipped with an electric cooker, consume month $e^{0{,}34} \approx 1{,}40$ times more electricity than households living in dwellings without an electric cooker. Therefore, energy consumption increases by 40 % if there is an electric cooker. Households living in a cold climate, consume an average of $e^{0{,}16} \approx 1{,}17$ times (or 17 %) more electricity than households living in warm and temperate climate.

Let us analyze the increments electricity consumption by increasing household size for one person. Note that the increments depend not only on the number of household members, but also on other factors included in the model. Consider, for example, households that do not have an electric cooker, live in urban areas with a warm or temperate climate. The calculations results of predicted electricity consumption and increments depending on the number of household members are presented in Table 4 and illustrated in Fig. 4.

Table 4

Predicted electricity consumption for households living in urban areas with a warm or temperate climate, depending on the number of household members, kW·h per month

The number of household members	Predicted electricity consumption	Increment of predicted electricity consumption by increasing the number of household members per person
1	88	—
2	124	36
3	152	28
4	175	23
5	195	21
6	214	19

Source: Calculated by the author by the model (13).

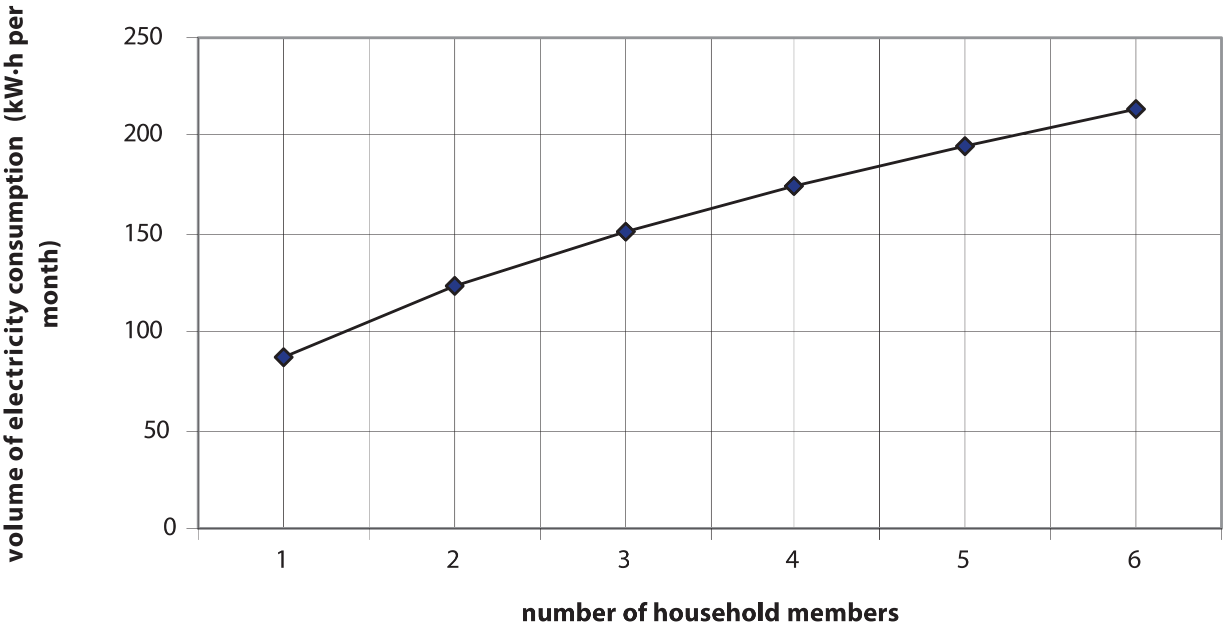

Fig. 4. *Predicted electricity consumption for households living in urban areas with a warm or temperate climate, depending on the number of household members*

The growth of household size from one to two members increases the electricity consumption of 36 kW·h per month, adding a third member of the household increases the power consumption of 28 kW·h per month, etc.

Calculation of a reasonable social norm of electricity consumption based on the developed model

The developed model allows calculating the expected electricity consumption by the households of different types. According to the regulations, the volume of supply within the social norms should not be less than 70 % and not more than 85 % of the actual amount of supply of electric power to the population. Therefore, we calculate 70- and 85-percent quantile for the total electricity consumption of each household category. Social norm should be established between these quintiles.

Taking into account that residuals in the model have a normal distribution, we can construct the one-sided 70 and 85 per cent confidence intervals for the electricity consumption per month Q for each type of household from the equations $P(Q < q_{0,7}) = 0,7$ and $P(Q < q_{0,85}) = 0,85$. Then the social norm of electricity consumption should be in the range from $q_{0,7}$ to $q_{0,85}$.

We use the standard theory of the prediction of regression analysis to calculate confidence intervals [15, c. 86–87]. If $\hat{y}(x^p)$—predictive value of the factor y for a given vector of explanatory variables x^p, then the random variable $\frac{\hat{y}(x^p)-y(x^p)}{s(x^p)}$ has a t-distribution with $n-r-1$ degrees of freedom, where $s(x^p)$—the standard error of the predicted value, n—sample size, r—the number of explanatory variables. Consequently, the right boundary of the one-sided $\alpha \cdot 100$ % confidence interval for $y(x^p)$ is given by $\hat{y}(x^p)+s(x^p)\cdot t_\alpha(n-r-1)$, where $t_\alpha(n-r-1)$ is the $\alpha \cdot 100$ % quantile of the t-distribution with $n-r-1$ degrees of freedom.

Taking into account that the explanatory variable is the logarithm, the right boundary of the confidence interval for the household electricity consumption per month is $\exp\left(\ln(x^p)+s(x^p)\cdot t_\alpha(n-r-1)\right)$. Table 5 presents the results of calculating the 70 %- and 85 %-quantile of electricity consumption for households without an electric cooker, living in urban areas with a warm or temperate climate. The values of dummy variables equal to zero for these households.

Thus, the requirement of "the volume of delivery within the social norms should not be less than 70 % and not more than 85 % of the actual volume of electric energy supply to the population" leads to the following size of social norms. Social norm for the considered type of households consisting of one person should be from 111 to 139 kW·h per month. Social norm for the households of two persons should be from 156 to 196 kW·h per month, etc.

We assume further that the social norm will be set at the lower allowable level. Let us divide households into eight types depending on living conditions (Table 6). Social norms of electricity consumption, calculated by the model for the eight types of households, depending on the number of members are presented in Table 7 and Fig. 5.

Table 5

70 %- and 85 %-quantile of electricity consumption for households without an electric cooker, living in urban areas with a warm or temperate climate, kW·h per month

The number of household members	Predicted electricity consumption	70 %-quantile of electricity consumption	85 %-quantile of electricity consumption
1	88	111	139
2	124	156	196
3	152	191	239
4	175	220	276
5	195	246	308
6	214	270	338

Source: Calculated by the author by the model (13).

Table 6

Characteristics of household types

Type of household	Type of settlement	Climate	The presence or absence of electric cooker
1	urban area	warm or temperate	no
2	urban area	warm or temperate	yes
3	urban area	cold	no
4	urban area	cold	yes
5	rural area	warm or temperate	no
6	rural area	warm or temperate	yes
7	rural area	cold	no
8	rural area	cold	yes

Source: constructed by the author.

Table 7

Social norms of electricity consumption, calculated by the model for the eight types of households, depending on the number of members, kW·h per month

Type of household	The number of household members					
	1	2	3	4	5	6
1	111	156	191	220	246	270
2	155	218	267	308	344	377
3	130	183	224	259	289	317
4	182	257	314	362	405	443
5	126	178	218	251	281	307
6	176	249	305	351	393	430
7	148	209	256	295	330	361
8	207	293	358	413	462	506

Source: Calculated by the author by the model (13).

We calculate the increments of the social norms with increasing household size for one person and compare them with the values recommended by the regulations. Table 8 presents the calculation results.

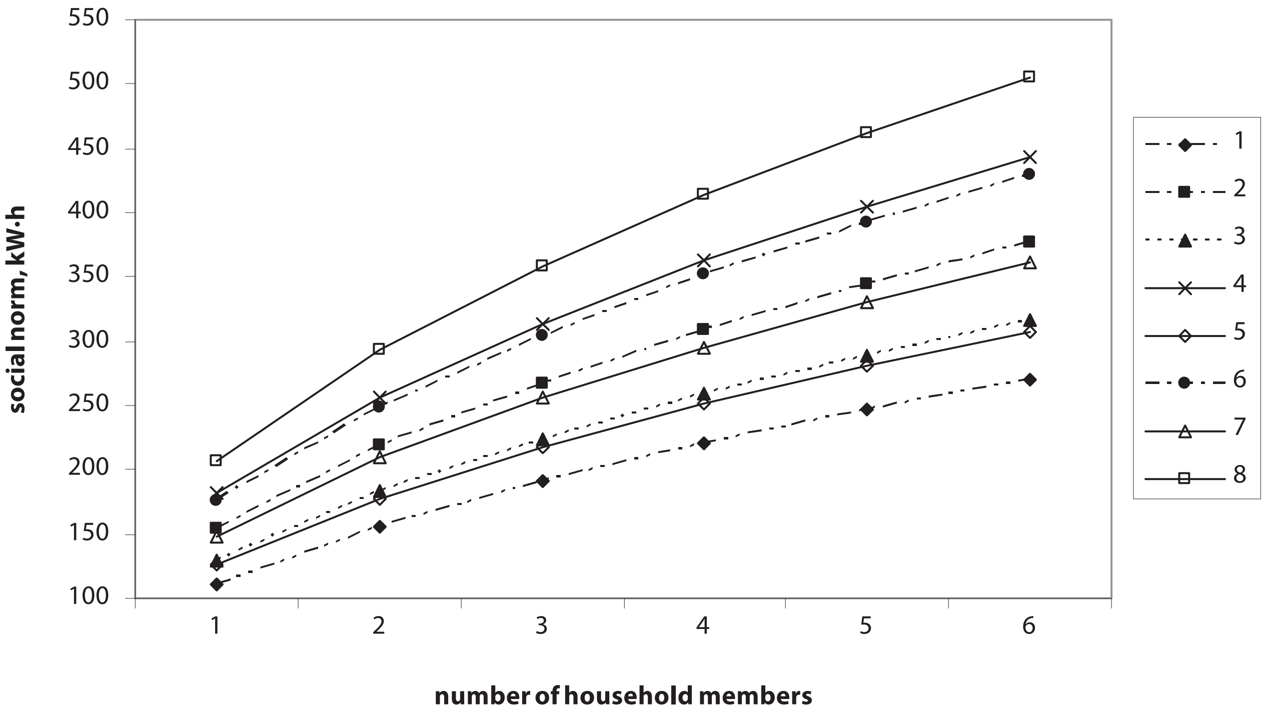

Fig. 5. *Social norms of electricity consumption, calculated by the model for the eight types of households, depending on the number of members*

Table 8

Increments of the social norms with increasing household size for one person calculated by the model, kW·h per month

Type of household	The number of household members					
	1	2	3	4	5	6
1	—	45	35	29	26	23
2	—	64	49	41	36	33
3	—	53	41	35	30	27
4	—	75	57	48	43	38
5	—	52	40	33	29	26
6	—	73	56	47	41	37
7	—	61	47	39	35	31
8	—	85	65	55	49	44

Source: Calculated by the author by the model (13).

Decree regulates the increase of social norm for a second member of the household 60 kW·h. The calculation results demonstrate that this supplement is insufficient for certain types of households (4-th, 6-th and 8-th). These households live in dwellings with an electric cooker, in a cold climate or in rural areas.

Decree regulates the increase of social norm of 40 kW·h for all subsequent household members. This value is also not enough for certain types of households. For the eighth type of households living in a cold climate, in rural areas, in dwellings with an electric cooker, a supplement for the third household member must be 65 kW·h, and for all subsequent 50 kW·h.

Conclusion

In this study, we present an econometric model that allows to calculate a reasonable social norm of electricity consumption for the different types of households, depending on the number of residents, the presence or absence of electric cooker, the type of settlement, the climatic conditions of the region where the household lives. The model is based on the budget survey data of Russian households.

According to the model, the rural households consume on average 14 % more electricity than the urban ones. Households living in dwellings equipped with an electric cooker, consume a month on average 40 % more electricity than the households living in dwellings without an electric cooker. Households living in a cold climate, consume on average 17 % more electricity than the households living in warm and temperate climates.

The simulation results show that the size of the social norm for households consisting of one person should be from 110 to 210 kW·h, depending on the living conditions. Then consumption within the social norm is 70 % of the total consumption of electric energy. The required increment of the social norm, depending on the type of household varies for the second member of the household from 45 to 85 kW·h, for the third—from 35 to 65 kW·h, for the fourth —from 29 to 55 kW·h, for the fifth—from 26 to 49 kW·h, for the sixth—from 23 to 44 kW·h. These values do not quite agree with the sizes of social norms calculated by the legally approved methodology. The values prescribed by Decree, are too low for certain types of households.

The constructed model takes into account the regional characteristics of energy consumption and can be useful for calculating the social norm of electricity consumption in the regions of the Russian Federation.

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