

Development of More Effective Principles of Subsidizing the Population in Need of Social Protection

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Abstract: *The article is devoted to the development of effective principles of providing subsidies for energy consumption to the population in need of social protection. The current situation in our republic has been studied and a scientific theoretical methodology has been created based on the results of the theoretical and practical analyzes conducted by scientists and international strategic actions regarding this problem. The population is divided into 4 strata and their level of electricity consumption and use of subsidies is explained on a mathematical basis. Conclusions on the provision of subsidies have been made with theoretical analysis and allow to increase the price of electricity by 2 times and reduce the amount of subsidies by almost 2 times according to the principle that the payment for electricity of poor families will remain unchanged. Based on the principle of determination based on the specified share of family income, the possibility of subsidizing the amount of electricity not exceeding 5% of the family income is explained.*

Keywords: social protection, subsidy, energy bills, energy efficiency

1. Introduction

Subsidies for energy consumption are usually given during major reforms in the energy system. Because modernization of the energy system or reforms to improve energy efficiency require attracting large investments or increasing energy bills. It is necessary to provide assistance to the population in need of protection. According to official data, 12-15% of the population of Uzbekistan is considered to be in need of social protection. This is 4.3-5.4 million inhabitants of our country. It is known that at the moment subsidies are given to all consumers of electricity, not only to the part of the population that needs social protection. Currently, all residents receive a subsidy of 100-150 UZS for each kWh consumed. According to the official information provided by the Ministry of Energy, 80% of the electricity supplied to the population is consumed by rich consumers, who make up 20% of the population. The given subsidies are mainly used by rich consumers. In this case, the amount of subsidies used by the population in need of social protection does not exceed 5%. This problem is one of the urgent problems facing not only our republic, but also the world community.

In his article, David Bienvenido-Huertas analyzes the effectiveness of unemployment benefits and social security benefits to help Spanish family units pay their electricity bills during the COVID-19 pandemic. The result of the analysis showed that the unemployment benefit can contribute to alleviating energy poverty if the unemployed person is in a low-paid job or works for few hours. However, social protection benefits have been found to be insufficient to prevent energy poverty. "The possibility of supporting the stratum in need of social protection by introducing a variable discount percentage in the payment for electricity in accordance with the variable income of the population" was

studied during the scientific research [1].

J.M. Doremus, I. Jacqz, and S. Johnston in their article examine whether energy costs for US residents depend on hot or cold weather, focusing on estimating the difference between low- and high-income households. Climate change characterized the U-shaped classification of the energy consumption graph, that is, the increase in the share of energy costs among the poor population. As a result, it was learned during the observations that the population will be forced to reduce primary consumption expenses. It is noted that there are no practical solutions to this problem in any social programs in use [2].

Foreign experience has shown that it is expedient to carry out analyzes of individual sectors when assessing energy efficiency.

Many European countries have developed energy efficiency improvement programs through tax incentives and subsidies. For example, in Italy, in 2007-2013, taxes were reduced by 55% under the line "Reduced tax program to ensure energy efficiency". Due to this, a total of 23 billion euros have been invested in the installation of new electrical appliances and capital equipment with high energy efficiency, with an average cost of more than 1.8 million euros each. In Great Britain in 2002-2013, the "Warm Front" program adopted to combat the "Energy Shortage" subsidized measures to ensure thermal insulation. This program was used by 1.7 million households in the UK between 2001 and 2011, resulting in a 35% reduction in average energy consumption from 63GDj/m to 4163GDj/m.

In the Netherlands, the government allocated 400 million euros of subsidies to local authorities to improve the energy

efficiency of housing funds. The Energiesprong development program connects homeowners with financial and industrial organizations and aims to renovate and modernize more than 111,000 residential buildings to nearly zero energy consumption. In New Zealand, "Warm Up Heat Smart" program households were given subsidies in the amount of 300 million US dollars to improve the energy efficiency of buildings. In South Korea, a regulatory system has been developed that specifies minimum energy efficiency requirements for more than 30 electricity consumers. The European Union, Switzerland, Australia, Canada, Japan, New Zealand, and Taiwan have implemented the "Energy Star" program. This program was developed by the US Department of Energy and the Environmental Protection Agency, and includes product labeling, technical regulations established in international standardization processes, and restrictions on energy consumption. In the USA in 2013 alone, 300 million household appliances with the "Energy Star" brand were purchased, as a result of which 0.5 TWh of electricity was saved. These activities also gave positive results.

2. Methodology

One of the factors that actively influence energy saving is the price of electricity. Germany has the most expensive electricity among European countries. This is because the country has no fuel reserves and hydro resources for energy production, as well as bans on nuclear power. Among the countries under consideration, France uses the cheapest electricity among the countries whose GDP per capita is more than 30,000 dollars. The reason for this is that nuclear power plants are actively operating here. It should be noted that the presented data correspond to the prices of electricity for the population of the countries.

The analysis shows that subsidies should be given mainly for the installation of equipment based on environmentally friendly energy sources and energy-efficient technologies [3],[4]. In particular, the effect of universal subsidies will not be positive.

In order to verify the above data, we will perform the following calculations. We divide the population into 4 groups according to the weight of electricity use. We include the population in need of social protection in group 1. We assume that this layer is 20% of the population (7.2 million people) and consumes x -units of electricity. The next group 2 (layer) is the middle income layer, which makes up 30% of the population (10.8 million people) and consumes 50% more energy than the 1st group, i.e. $1.5x$ units of energy. Group 3 also makes up 30% of the population (10.8 million people) and consumes twice as much ($2x$ units) compared to group 1. The 4th group is a rich stratum of the population, which makes up 20% of the population and consumes 3 times ($3x$ units) of energy compared to the 1st group. Electricity consumed by the population is 21% of the total energy consumption (14.7 billion kWh). Taking into account the above, we create the following equation. The total energy consumed by 4 groups is equal to the energy consumed by the population:

$$W_y = 7.2 \cdot x + 10.8 \cdot 1.5x + 10.8 \cdot 2x + 7.2 \cdot 3x =$$

$$7.2x + 16.2x + 21.6x + 21.6x = 66.6x = 14.7 \text{ billion kWh}$$

$$x = 0.22 \text{ person kWh/ year}$$

A person from the poorest part of the population consumes 220 kWh of electricity per year. Putting this value in the above expression, we determine the consumed electricity in all groups and determine its weight in the total consumption as a percentage. We determine the amount of subsidies used by each group and their weight as a percentage, setting the amount of subsidy allocated to each kWh as 100 UZS/kWh. We include the results of the calculations in the table below.

Table 1: Need for energy among the population (1st option)

Population class	%	Population, mln	Multiplicity of consumption	Consumption energy	%	Subsidy amount	%
Poor	20	7.2	1	1.58	10	158	10
Medium	30	10.8	1.5	3.56	24	356	24
Above average	30	10.8	2	4.75	32	475	32
Rich	20	7.2	3	4.75	32	475	32
	100	36		14.7	100	1470	100

It can be seen from this table that the poor group, which is 20% of the population, receives only 10% of the subsidy, while the richest group, which is the same amount of the population, receives 32% of the subsidy. The upper middle and rich class, who do not need subsidies, receive 64% of the subsidy. It can be seen from the results that the main part of this subsidy is received by the rich segment of the population.

In the 2nd option of the energy consumption of the population, we take the maximum value of the poor part of the population indicated in the official data: 15% (5.4 million people). Taking the middle class as 35% (12.6 million people), we repeat the calculations and create the following equation.

$$W_y = 5.4 \cdot x + 12.6 \cdot 2x + 10.8 \cdot 3x + 7.2 \cdot 4x =$$

$$5.4x + 25.2x + 32.4x + 28.8x = 91.8x = 14.7 \text{ billion kWh}$$

$$x = 0.16 \text{ person kWh/ year}$$

We include the results of the calculations in the table below.

Table 2: Need for energy among the population (2nd option)

Population class	%	Population, mln	Multiplicity of consumption	Consumption energy	%	Subsidy amount	%
Poor	15	5.4	1	0.86	5.8	158	10
Medium	35	12.6	2	4.03	27.1	356	24
Above average	30	10.8	3	5.18	35.1	475	32
Rich	20	7.2	4	4.6	32	475	32
	100	36		14.7	100	1470	100

It can be seen from the table that the poor part of the population uses 5.8% of the subsidy, and the rest of the subsidy is used by the segments of the population who do not need the subsidy.

3. Results and discussion

Taking into account that a significant part of the population of our republic is made up of families in need of social protection, it is necessary to provide subsidies to these families when the payment for electricity is increased. Subsidies should be directed not to consumed electricity, but to persons in need of social assistance. When determining the part of the population that will be subsidized for energy payments, it is necessary to determine the percentage of the family income that energy payments make up. For example, taking into account that energy payments should not exceed 5% of family income, and based on the above results, the following conclusions can be drawn regarding the current subsidy.

- Subsidies for electricity should not be given in the form of money, but in the form of free energy demand.
- It should be ensured that subsidies are provided in the form of free electricity only to people in direct need of social assistance.
- When determining the part of the population that will be subsidized for energy payments, it is necessary to determine the energy payments in Uzbekistan based on the share of family income or on the principle that payments remain unchanged in this segment of the population.
- Providing a subsidy in the form of free energy to a vulnerable group has the following advantages:
- The subsidy is delivered only to the population in need of social protection, and other categories of consumers are not eligible to receive this subsidy.
- The subsidized consumer tries to save electricity as much as possible in order to bring the energy consumed to a free value.
- The economic effect that will be saved in connection with the suspension of the subsidy to the non-poor stratum (30.4 million people), which currently receives 94% of the subsidy, is 1.31 trillion UZS in one year
- When the price of electricity increases, consumers from the poorer part of the population will not protest because the payment value remains unchanged.

The amount of the subsidy can be determined based on 2 principles: based on the fact that poor families will not change their current electricity bill and based on a fixed share of the family's income.

Based on these principles, we determine the definition of payment and the amount of subsidy. In option 1, we determine these values based on the principle that the previous energy payment remains unchanged when the energy payment rate of a family in need of social assistance increases. For example, the family was currently paying 59,000 UZS for 200 kWh of electricity. The payment for electricity was doubled and set at 600 UZS/kWh. The

subsidy amount is determined as follows. The amount of the additional payment after the increase in the payment amount:

$$\Delta U_q = C_{n.b} \cdot W_m - U_{o.b} = 600 \cdot 200 - 59000 = 61000 \text{ UZS}$$

$$C_{n.b}$$
 - new payment rate, UZS/kWh; W_m - amount of consumed monthly electricity, kWh; $U_{o.b}$ - old monthly payment amount, UZS.

According to the new tariff, 101 kWh of electricity will be provided for this 61,000 UZS. Thus, 101 kWh of electricity consumed by the family will be paid by the state, and the family will pay for the excess. This amount of electricity is given to the consumer in the form of a subsidy. If we assume that each family consists of 5 people on average, the number of poor families of 5.4 million people will be 1.1 million. When these families receive an average of 61,000 UZS (101 kWh) in the form of a state subsidy, the annual total subsidy value is determined from the following expression:

$$U_s = N_{p.f} \cdot N_m \cdot \Delta U_q = 5100000 \cdot 12 \cdot 61000 = 805,2 \cdot 10^9 \text{ billion UZS}$$

$N_{p.f}$ - the number of poor families; N_m - number of months.

It can be seen that this value is 664.8 billion UZS less than the value of the subsidy provided by the state (from 1470 billion UZS) and is almost 2 times less. This will allow to increase the price of electricity by 2 times and reduce the amount of subsidy by almost 2 times without increasing the payment of poor families.

Thus, the amount of free energy (subsidy) provided to a poor family is determined from the following expression:

$$W_{s1} = W_m - \frac{W_m - C_{o.b}}{C_{n.b}} = \frac{W_m \cdot (C_{n.b} - C_{o.b})}{C_{n.b}}$$

Here: W_m - is the monthly energy consumption of the family, kWh; $C_{n.b}$ and $C_{o.b}$ - new and old payment rate, UZS/kWh.

In the 2nd option, we calculate the amount of the subsidy based on the specified share of the family income. In Table 3, this indicator in foreign countries is analyzed and it averages 5-7%.

Table 3: Share of energy payment in family income in foreign countries and Uzbekistan

Countries	Monthly consumption kWh	Payment rate, cents/kWh	Amount, dollar s/kWh	Average salary, dollars.	Payment weight in relation to wages, %	Multiple payment compared to Uzb
Uzbekistan	223	2.6	5.81	340	1.7	1 (1)
Lithuania		50.2	111.94	1811	6.1	3.6 (19)
Moldova		14	70.5	461	6.8	4 (5)
Greece		27	60.2	1203	5.0	2.94 (10)
Bangladesh		5.3	11.8	153	7.7	4.5 (2)
Czechia		45.8	102.1	1752	5.8	3.41 (17)
Mexico		9.8	21.85	389	5.6	3.3 (3.8)

Based on the experience of foreign countries, we set the maximum value of the increased payment rate for electricity

at 3% of the average salary in Uzbekistan for 200 kWh. That is, $3980 \cdot 0.03 = 119,400$ UZS for 200 kWh. From this value, we accept the payment rate for 1 kWh of electricity as 597 UZS /kWh or 600 UZS/kWh. The amount of energy payment for 200 kWh allocated to the family should not exceed 5% of the family income. We will consider the determination of the amount of the subsidy on the example of several families. 40 kWh of electricity per person per month should be planned.

Example 2. The family consists of 5 people and the total income of the family is 1,200,000 UZS. The monthly demand of the family is $40 \cdot 5 = 200$ kWh, and the monthly payment is $200 \cdot 600 = 120,000$ UZS. 5% of the family income pays this amount in 60,000 UZS (100 kWh). Subsidized energy is the remaining $200 - 100 = 100$ kWh. In this case, the family will pay 60,000 UZS for 200 kWh of electricity or 300 UZS per kWh. If this family saves electricity and reduces consumption to 150 kWh, the family pays only for 50 kWh of electricity, and one kWh of electricity is $30000/200 = 150$ UZS/kWh. Thus, the family will have the opportunity to pay less than before after the tariff increase. This will be a great incentive to save energy in the family.

Example 3. The family consists of 7 people and the total income of the family is 4,500,000 UZS. The monthly consumption of the family is $40 \cdot 7 = 280$ kWh, and the monthly payment is $280 \cdot 600 = 168,000$ UZS. Since 5% of the family's income is 225,000 UZS and is greater than the amount of the payment, the family pays the energy in full. The family is not provided with free energy through a subsidy. Because the payment for 200 kWh for 5 people (120 thousand UZS) is 2.6% of the family income.

Thus, the amount of electricity (subsidy) provided free of charge to a family in need of social protection is determined from the following expression:

$$W_s = W_m - \frac{IF - \varphi_b}{C_b}$$

Here:

W_m – is the monthly energy consumption of the family, kWh; IF – monthly income of the family, million UZS;

φ_m -share of family income determining the fee paid by the poor family, 5%;

C_b -payment rate, UZS/kWh.

The monthly income of the family receiving the subsidy must be less than the following value:

$$IF_m = \frac{W_m \cdot C_b}{\varphi_b} = \frac{200 \cdot 600}{0.05} = 2400000 \text{UZS}$$

Currently, 10-15% of the population of Uzbekistan are considered poor families. This is 3.5-5.4 million people. Considering their number as an average of 5 million, there are 1 million families with an average of 5 people in a family. If we take the average income of these families as 1.2 million, the amount of free electricity provided to them is 100 kWh, and the total amount of free electricity provided to families in need of social protection for one year (12 months) is 1.2 billion kWh. This is 8.1% of the energy consumed by the population of Uzbekistan (14.7 billion kWh). In this case, the amount of payment paid by the population for 1 kWh of electricity is on average 551 UZS or subsidy (49

UZS) or 8.1%. Currently, this subsidy is $(403 - 295 = 108$ UZS) per kWh of energy or 26%, and this subsidy is mainly used by rich consumers who consume 80% of electricity.

4. Conclusions

Based on the above results, the following can be concluded:

- 1) Currently, the introduced payment for electricity consumption for the population in Uzbekistan is one of the lowest in the world, not only in terms of nominal value, but also in relation to the average wage, it is possible to raise it to a working value.
- 2) The value of the amount of subsidy given to the population should be determined on the basis of 2 principles: based on the fact that the current payment for electricity for poor families remains unchanged and does not exceed the specified share of the family's income.
- 3) Subsidizing poor families in the form of free energy allows these families to double the price of electricity without changing their energy bills.
- 4) Providing subsidies in the form of free electricity to the population in need of social protection will allow to reduce the current subsidy by 3 times (from 26% to 8.1%).
- 5) In order to modernize the energy sector in Uzbekistan and transfer it to free economic relations, it is appropriate to make payments for electricity in several stages.

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