

## International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at <http://www.econjournals.com>

International Journal of Energy Economics and Policy, 2017, 7(2), 327-336.



# Implementation of the Regional Investment Project of Energy Efficiency Increase of the Enterprise of Belgorod (According to Belvodokanal GUP)

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### ABSTRACT

The purpose of this study is to monitor the execution of the investment program approved by the state unitary enterprise GUP Belvodokanal for the construction, reconstruction, modernization and development of the centralized water supply systems, sewerage and purification of waste water of the city of Belgorod in the period from 2014 to 2018, as well as the proposals related to the improvement of the investment program. The scientific methods, general scientific principles of dialectical development and system approach are used in this article. The main results: The analysis of the existing problems of Belgorod GUP of Belgorod are presented, the efficiency of the investment under the approved investment program is assessed, the analysis and evaluation of the efficiency of capital investments under the project as well as the risk assessment and the planned specific decline in the introduction of the additional measures to the investment program in the field of water supply, approved by Belvodokanal GUP, are conducted.

**Keywords:** Investment Program, Investment, Capital Investment, Economic Efficiency, Energy Efficiency, Payback Period, Risks

**JEL Classifications:** H54, L95, O10

## 1. INTRODUCTION

The efficiency of any activity of the enterprise, including the investment activity, depends largely on its organization. One of the most rational ways of efficient organization of the investment activity is the development and implementation of the investment programs. In the economical literature, the investment program of the enterprise is usually seen as a set of implemented investment projects. However, some authors do not consider this definition as sufficiently complete and accurate. Although the main content of the investment program are, of course, the investment projects contemplated by it, but at the same time it cannot be reduced to a simple list of investment projects. The investment program can be identified as follows:

- As a means of implementation of the strategic plan of the enterprise;
- As the independent planning document, closely associated with the strategic plan of the enterprise, but developed and approved in a special manner;
- As a section of the company’s annual business plan 0.

Currently, the municipal economy is one of the fields with a sufficiently clear formulated concept of transformation with the regulatory framework of the federal level, ensuring the realization of the potential reserves to increase the efficiency of the functioning of the municipal economy and to reduce the need for the budget subsidies for its maintenance. At the same time, the attempts of the state to influence directly the process of transition

of the housing funds under the real management of the property owners, the fund of owners, created in the housing sector, are clearly outside the scope of sectoral reform (Bazhenov, 2011). All this has determined not only the adjustment of the course of changes in this individual sector, but the foremost position of the housing and municipal reform and the energy-saving strategies in the economic policy of Russia, including the development of the investment programs at the state level.

The investment program is a program of financing of the construction and upgrading of the electrical systems, heating, water supply, sanitation and the facilities, used for the technical waste disposal, in order to implement the program of integrated development of the municipal economy infrastructure systems. The investment program defines the cash flows, the sources and the amount of financing in accordance with the federal laws. The municipal economy systems management can be implemented via the administrative, fiscal and tariff levers. The execution of the objectives of the investment programs is complicated by the fact that many cities and settlements lack the experience in the municipal energy planning. Many of them have no updated general urban development plans.

## 2. METHOD

The methods of scientific direction, general scientific principles of dialectical development and system approach are used in this article. The research methodology is based on the basic provisions of the Federal Law of the Russian Federation (RF) of December 7, 2011 No. 416-FZ; RF Government Decree of December 31, 2009 No. 1225 "On Requirements to Regional and Municipal Programs in the Field of Energy Saving and Energy Efficiency," the "Energy Strategy of the RF for the Period till 2030" (Bazhenov, 2011); the Order of the Ministry of Economic Development of the RF of February 17, 2010 No. 61 "On Approval of the Indicative List of Activities in the Field of Energy Saving and Energy Efficiency, Which can be Used for the Development of the Regional and Municipal Programs in the Field of Energy Saving and Energy Efficiency" (2010); Federal Law of November 23, 2009 No. 261-FZ On Energy Saving, on Energy Efficiency Improvements and on Amendments to Certain Legislative Acts of the RF (2009); the Orders of the RF Energy Strategy for the Period till 2030 (No. 1715-p, 2009); the Federal Law of December 7, 2011 No. 416-FZ "On Water Supply and Sanitation" (2011); RF Government Decree of December 31, 2009 No. 1225 "On Requirements to Regional and Municipal Programs in the Field of Energy Saving and Energy Efficiency" (2009); the Energy Strategy of the RF for the Period till 2030 (2006); (Ob Utverzhdenii Rekomendatsii po Provedeniyu Energeticheskikh Obsledovaniy, 2006). The Federal Law of December 3, 2011 No. 382-FZ "On the State Information System of the Fuel and Energy Complex" (2011).

## 3. RESULTS

### 3.1. The Analysis of the Existing Problems of Belgorodskiy Vodokanal GUP

The analysis of water supply and wastewater facilities of Belgorodskiy Vodokanal GUP shows their considerable wear,

which leads to a decrease in the quality of services provided, the increase in energy intensity of production, as well as the significant loss of cold drinking water during the transportation to the end user. The accident statistics for the period from 2010 till 2014 is shown in the Table 1.

The following Table 2 represents the number of leaks and blockages in the sewer networks.

The percentage of accidents on the networks remains very high, and the proportion of the networks need to be replaced is high also. Water supply networks are the weakest and most vulnerable point in the system of production and distribution of cold fresh water, as well as the sewage in the wastewater discharge system. The integrated work towards the reduction of the number of accidents on water supply and sanitation networks allowed to reduce slightly the amount of specific accidents on the water supply networks, while the accident rate in the sewer networks has not changed much. The pace of network relaying is clearly insufficient.

The obsolete electrical and pumping equipment for water and sewage pumping stations does not allow to ensure the stable operation for pumping of fresh water and wastewater, while the energy costs are constantly increasing. The replacement of the pumping equipment with more modern and energy-efficient is required as well as the introduction of the resource-saving policy not only in the framework of a company as a whole, but it also should be brought to the notice of every citizen residing in the territory of the Belgorod region. The main problem of sewage treatment facilities is the lack of tertiary sewage treatment unit, without which it is impossible to achieve the purity that meets the requirements of maximum permissible concentration for fish-ponds of household purposes.

The foreign experience on this study is noteworthy: Denmark ranks first in Europe in terms of tariffs for electricity and natural gas for the population.

The prices for industrial consumers are almost three times lower, and even less than the EU average. The persistent, almost "brainwashing," energy saving promotion in the country does its bit. Dong Energy has no shortage of customers, including the industrial ones, willing to implement collaboratively the energy-saving projects. Saving energy with the help of Dong Energy provides such activities as, for example: Replacement of the lamps with more efficient ones; modernization of the electrical equipment; identification and elimination of potential points of electricity losses; the transition of the energy-intensive equipment to the overnight operation, when the electric energy is cheaper, etc. According to the company, in some cases, the reduction of power consumption can be 30% or more. Naturally, Dong Energy is paid for the energy consulting, and it recommends the consumer what equipment to purchase and to install in case of replacement. It is known that the company actually tries to offer the best possible solutions and does not charge any fee from suppliers of energy-saving equipment for the actual promotion of their products. The main objective of Dong Energy is to provide the customers with the most energy savings. Moreover, since 2007, the company has been

**Table 1: The number of technological damages to water supply systems**

Year	The length of the networks in operation, km	The length of the networks requiring replacement, km	The length of replaced networks, km	The number of technological damage to networks total/ pcs. a day	The number of technological damage to networks pcs./km
2010	1,032.890	351.20	1.210	4,780/13.10	4.63
2011	1,049.975	353.10	0.410	4,675/12.81	4.45
2012	1,050.113	357.80	1.410	4,661/12.73	4.44
2013	1,120.060	362.00	1.150	4,238/12.69	3.78
2014	1,338.000	617.00	2.000	4,052/11.10	3.52

**Table 2: The number of leaks and blockages in the sewer networks**

Year	The length of the networks in operation, km	The length of the networks requiring replacement, km	The length of replaced networks, km	The number of technological damage to networks, total/pcs. a day	The number of technological damage to networks pcs./km
2010	697.50	249.92	0.71	4,416/12.10	6.33
2011	705.84	250.00	1.19	4,363/11.95	6.18
2012	705.85	250.20	1.46	4,383/11.98	6.21
2013	707.97	257.12	0.14	4,425/13.25	6.25
2014	909.00	277.00	1.00	4,283/11.73	6.17

offering the so-called “climate partnership.” Having concluded such a contract, the customers do not obtain any financial gain. The savings due to the reduction of electricity consumption are directed to purchase from Dong Energy of more expensive, clean (and produced without carbon dioxide emissions) electricity produced by the wind power. The first such contract was concluded in 2007 with the Danish pharmaceutical company Novo Nordisk. Through the implementation of a series of events, the consumption of the power by the Novo Nordisk enterprises in Denmark has decreased to 30% over the 3 years. The company converted these savings to purchase from Dong Energy the electricity generated by the windfarm Horns Rev 2, one of the largest in Europe (Boldyreva, 2007).

As of the beginning of 2012, Dong Energy has signed more than 100 “climate contracts.” According to Anders Eldrup, Managing Director of Dong Energy, due to such agreements, the company plans to increase gradually the share of renewable energy generation. If in 2006, Dong Energy has received 85% of its electricity from burning fossil fuels and 15% from alternative sources, by 2040 the company plans to change this ratio in the reverse. (By the way, Denmark is the only self-sufficient in oil and gas country in the EU (Foreign Experience in Energy Saving Technologies: Material of Parliament Library, 2011). In recent years, Dong Energy has extended its energy-saving initiatives in the household. In the framework of the pilot project launched in 2010, the company has been working with a group of 155 families, which agree to use their household as the testing ground for the development of the energy-saving technologies. A number of recommendations on saving of energy and resources, addressed to the individuals, are published on the website of the company. Their main point is that we need to live more modestly, to consume less, and be more responsible to the use of water, electricity and heat (Boldyreva, 2007).

Along with the new directive, other proposals on energy conservation promotion are put forward in modern Europe. In particular, the experts suggest to adopt the experience of Japan, which has been implementing the Top Runner Program since

1998. The gist of it is that the companies, producing various energy consuming equipment (from cars and boilers to computers and television sets - all in all 23 categories), under the threat of fines should annually maintain a weighted average of energy efficiency of their products in each category at a level not lower than the industry average (Foreign Experience in Energy Saving Technologies: Material of Parliament Library, 2011).

Therefore, the company with not very cost-effective equipment in its product range can compensate it with the production of the other, more cost-effective equipment. According to European experts, in the period from 1999 to 2006 the energy saving categories amounted to 22.8-73.6% and the consumption of the electricity by Japanese households in 2010 was 10% less than in 1999.

According to other experts, the American experience is also noteworthy. In 20 states of the US, the energy saving measures at the household level are actually funded by the loans provided by the energy companies (Foreign Experience in Energy Saving Technologies: Material of Parliament Library, 2011).

### 3.2. The Efficiency of the Investment of the Funds of the Approved Investment Program

The implementation of the approved investment program must result in the following:

- The increase in the water intake capacity by 24 thousand m<sup>3</sup>/day;
- Construction of 22.78 km of water supply networks;
- The construction of 3.15 km of sewerage networks;
- The construction and reconstruction of 3 units of pumping stations of the 2<sup>nd</sup> and 3<sup>rd</sup> ascents;
- The construction of 1 clean water reservoir with the volume of 10 thousand m<sup>3</sup>;
- The reconstruction of 4.2 km of water supply networks;
- The reconstruction of 13.42 km of sewerage networks;
- The construction of 1 new main sewer pumping station;
- The reconstruction of 1 sewer pumping station;

- The reduction of losses and unaccounted fresh water consumption up to 23% in 2018;
- The reduction of the number of process faults per year per 1 km of water supply networks from 4.44 in 2012 to 3.5 in 2018;
- The reduction of the number of technological damages (accidents) per year per 1 km of sewerage networks from 6.21 in 2012 to 5.5 in 2018. The efficiency of the implementation of the program activities is estimated in the social, economic and environmental aspects. The efficiency in the social aspect is achieved through the elimination of the negative influence of water factor on human health;
- The repletion of the needs of the population of the city in the high quality fresh water in an amount, corresponding to the norms of consumption. This effect is achieved by implementation of the measures for construction of the reservoir at the water intake No. 4, by drilling of new wells, by replacement of worn-out ones and construction of new pipeline sections.

The elimination of the risk of liquid chlorine poisoning of the population of the city and the staff of the sewerage structures in case of possible technogenic emergency situations related to its spillage is carried out via reconstruction of the system for disinfection of the discharged wastewater.

The elimination of the risk of pollution of the water intakes is achieved through the implementation of the measures on protection of the water system from the threats of natural and man-made nature. The investment program offers such activities as the construction of the sewerage networks in the city regions lacking the sewerage networks, located as close as possible to the existing water intakes (RF Government Decree No. 641, 2013). In the economic aspect, the efficiency may be assessed in the form of prevention of damage due to the measures aimed at the elimination of losses in water supply systems due to its efficient supply into the networks during the day and energy saving during the transportation of fresh and waste water. In the environmental

aspect the efficiency is achieved through a set of measures aimed at pollution prevention and improvement of the cross-border Seversky Donets River. This is achieved via the reconstruction of the existing system of disinfection of the wastewater discharged into the Razumenka River in 2016-2017, as well as through the construction of the wastewater after-treatment unit in the 2015-2018 and the reconstruction of the wastewater after-treatment units at the urban wastewater treatment plants in the period of 2014-2016. The implementation of the approved investment program of Belvodokanal GUP (water supply networks) is represented in Table 3.

The implementation of the approved investment program of Belvodokanal GUP (sewerage network) is represented in Table 4.

The Table 4 show that some of the activities of the investment program, approved for 2014, have not been met, which is primarily due to the lack of funding (the period of approval of the tariff, and, therefore, the tariff component does not allow to fully meet the financial needs for the implementation of the investment program). On the basis of the energy audits, as well as the analysis of the power equipment of Belvodokanal GUP, and, in particular, the pumping equipment, it can be concluded that at least 140 pumps of all types with the expired lifetime require replacement, and at least 39 variable-speed drives for the pumping equipment must be installed, the additional measures are also required to reduce the pressure in the water supply networks (in case of impossibility of replacement of the pump or installation of the variable frequency drive), which is achieved by trimming of the impeller and other technological solutions. In modern industry, it is achieved mostly not due to the introduction of new energy-saving technologies, but through the changes in the methods and methods of management. These methods include the mandatory implementation of ISO 50001 in Belvodokanal GUP, mandatory annual monitoring of energy inefficient equipment which does not meet the energy saving standards.

**Table 3: The implementation of the approved investment program of Belvodokanal GUP (water supply networks)**

Item No.	Source of funding	Total approved for the period of implementation of IP (full price)	Approved for 2014	Actual for 2014
	Total	1,001,464.37	50,970.17	16,501.80
1	Own funds	1,001,464.37	50,970.17	16,501.80
1.1	Profit available for investment	1,001,464.37	50,970.17	16,501.80
1.1.1	Due to connection fees	871,525.87	23,591.67	2,765.50
1.2	Depreciation deductions	0.00	0.00	0.00
1.3	Other own funds	0.00	0.00	0.00
2	Involved funds	0.00	0.00	0.00
2.1	Loans	0.00	0.00	0.00
2.2	Borrowings	0.00	0.00	0.00
2.3	Other involved funds	0.00	0.00	0.00
3	Budgetary financing	0.00	0.00	0.00
3.1	Federal budget	0.00	0.00	0.00
3.2	RF constituent entity's budget	0.00	0.00	0.00
3.3	Municipal budget	0.00	0.00	0.00
4	Other sources of funding	0.00	0.00	0.00
4.1	Leasing	0.00	0.00	0.00
4.2	Other	0.00	0.00	0.00

## 4. DISCUSSION

### 4.1. Analysis and Evaluation of the Effectiveness of Capital Investments Related to the Implementation of the Project

Table 5 shows the estimated cost of the equipment and the production of works on execution of the project. The planned budget for the project is displayed in the Table 6.

Based on the above considerations, the analysis of the effectiveness of capital investments with the use of net present value (NPV) indicator is presented in the Table 7.

It shows the amount of money the investor expects to receive from the project, after the cash inflows recoup the initial investment costs of the investor and the recurrent cash outflows related

**Table 4: The implementation of the approved investment program of Belvodokanal GUP**

Item No.	Source of funding	Total approved for the whole period of implementation of IP (full price)	Approved for 2014	Actual for 2014
	Total	989,662.42	32,283.30	12,661.30
1	Own funds	989,662.42	32,283.30	12,661.30
1.1	Profit available for investment	989,662.42	32,283.30	12,661.30
1.1.1	due to connection Fees	886,782.42	11,707.30	0.00
1.2	Depreciation deductions	0.00	0.00	0.00
1.3	Other own funds	0.00	0.00	0.00
2	Involved funds	0.00	0.00	0.00
2.1	Loans	0.00	0.00	0.00
2.2	Borrowings	0.00	0.00	0.00
2.3	Other Involved funds	0.00	0.00	0.00
3	Budgetary financing	0.00	0.00	0.00
3.1	Federal budget	0.00	0.00	0.00
3.2	RF constituent entity's budget	0.00	0.00	0.00
3.3	Municipal budget	0.00	0.00	0.00
4	Other sources of funding	0.00	0.00	0.00
4.1	Leasing	0.00	0.00	0.00
4.2	Other	0.00	0.00	0.00

**Table 5: The estimated cost of the equipment and the production of works on execution of the project**

The estimated cost of the equipment and the production of works on execution of the project	UM	In prices of 2015
Design works	Thousand ruble	13,000
Purchase of frequency regulators	Thousand ruble	904.8
Purchase of pumping equipment	Thousand ruble	62,000
Purchase of automation, telemetry devices for the remote control, instrumentation, etc.	Thousand ruble	42,430
Purchase of consumables for strapping of the equipment	Thousand ruble	2,300.2
Works on installation, strapping of the pumping equipment for water supply and sanitation, telemetry systems, as well as installation of frequency controllers on the available energy-inefficient pumps	Thousand ruble	27,115
Total	Thousand ruble	147,750

**Table 6: The planned budget for the project**

Denomination	Budget of the project, billion ruble	Budgetary sources		Extra-budgetary sources			
		Federal/Regional	Local	Investor funds (Energy Service Organization)	Funds of the economy subject	Borrowed funds	Other
Upgrading/replacement of the equipment according to the schedule of works	147.75	30.15*	-	101.00	16.30	0	0
Total	147.75	30.15	0	101.00	16.30	0	0

Source: \*The funds of the regional or the federal budget planned for allocation for the implementation of the energy saving and energy efficiency programs of Belvodokanal GUP

**Table 7: The analysis of the effectiveness of capital investments**

Indicator	0 year	1 year	2 year	3 year	4 year
The initial investment costs, rubles	-147.45	-	-	-	-
Cash flow, rubles	-147.75	74.35	80.30	86.72	93.66
Cash flow progressive total rubles	-147.75	-73.4	6.898	93.618	187.27
Discount factor at a rate of 20%	1	0.8333	0.6944	0.5787	0.4831
The discounted cash flow, rubles	-147.75	61.96	55.76	50.18	45.2
The discounted cash flow progressive total, rubles	-147.75	-85.79	-30.03	20.15	65.35

to the implementation of the project. Since the cash payments are assessed based on their time cost and the risk, NPV can be interpreted as the cost, added by the project.

The dynamics of changes in cash flow and the discounted cash flow is shown in Figure 1.

The presented data make it possible to calculate the NPV indicator. Since the cash payments are assessed based on their time cost and the risk, NPV can be interpreted as the cost, added by the project.

$$NPV = -IC + \sum NCF \tag{1}$$

Where,  
 NPV is the net present value, billion ruble  
 IC is the investment costs, billion ruble  
 $\sum NCF$  is the sum of net cash flows, billion ruble.

Detailed calculation:  $(-147.45)+61.96+55.76+50.18 = 65.35$  billion ruble.

Here  $NPV > 0$ , hence the additional measures to the investment program approved by Belvodokanal GUP for the construction, reconstruction, modernization and development of the centralized water supply systems, sanitation and purification of the wastewater of the city of Belgorod in 2014-2018, in our opinion, should be approved for implementation.

The profitability index (PI) is of great importance. In contrast to the net present effect, the above PI is a relative index and characterizes

the level of income per unit of costs, i.e., it can be said that the effectiveness of the investments is as follows: The higher the value of this index, the higher is the return on each ruble invested in the implementation of the additional measures to the approved investment program:

$$PI = \sum NCF/IC \tag{2}$$

Where,  
 PI is the profitability index  
 $\sum NCF$  is the sum of net cash flows, billion ruble  
 IC is the investment costs, billion ruble.

Detailed calculation:  $\frac{61.96+55.76+50.18}{147.45} = 1.14$ ; 1.14 rubles of profit can be obtained per 1 ruble of investments.

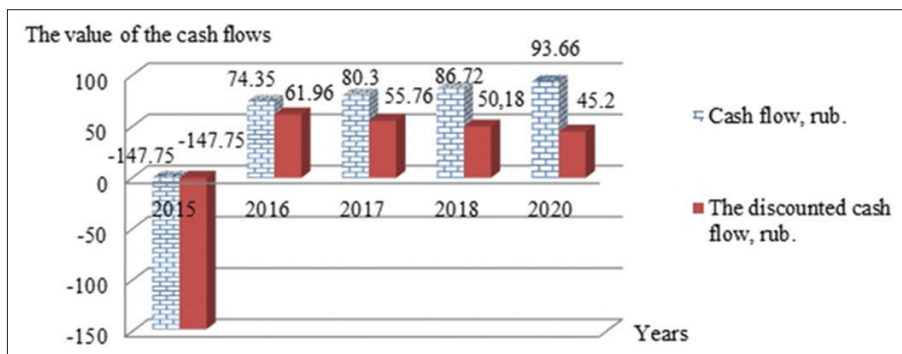
The dynamics of changes in cash flow by progressive total is presented in Figure 2.

Then, it is required to determine the payback period. For this purpose, the data on the cash flows and the cash flows based on the progressive total should be considered (Table 8).

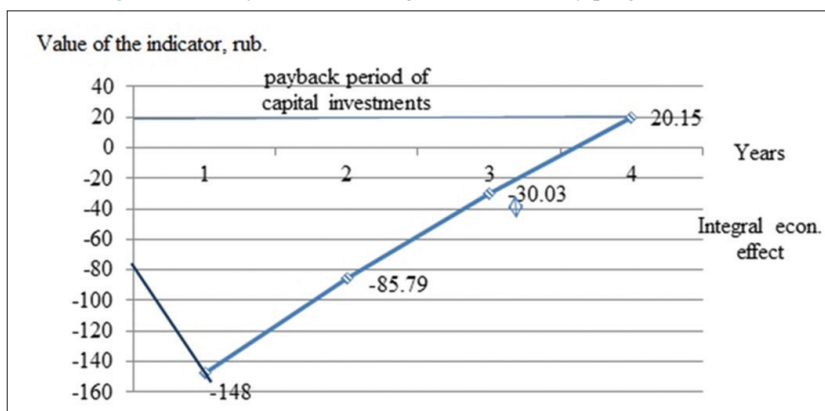
Thus, the project pays off within the first year. Let us calculate the exact payback period for the investment project, using the following formula.

$$PP = ((k-1)+(NPk-1)/(NPk-NPk-1)) \times L \tag{3}$$

**Figure 1:** Dynamics of changes in cash flow and the discounted cash flow



**Figure 2:** The dynamics of changes in cash flow by progressive total



Where,

PP is the payback period, days;

k is the approximate discounted payback period (2 years);

l is the duration of the calculation period (month, quarter, year) in days, which is expressed in the k index (365 days).

$$PP = (2 - 1) + \left( \frac{73.4}{73.4 + 6.898} \right) \times 365 = 699$$

The payback period for the investment project (PP) is 699 days or 1 year and 334 days. It is also necessary to determine the discounted payback period (Table 9).

$$DPP = ((k-1) + (NPk-1)/(NPk-NPk-1)) \times L \quad (4)$$

Where,

DPP is the payback period for the investment project, days;

k is the approximate discounted payback period for the investment project (3 years);

l is the duration in days of the calculation interval (month, quarter, year) in which the parameter k (365 days) is expressed.

$$DPP = ((3-1)/(30.03+20.15)) \times 365 = 949 \text{ days}$$

Accordingly, the discounted payback period is 2 years and 299 days.

## 4.2. The Risk Assessment and the Planned Specific Reduction of the Indicators in the Course of Implementation of the Additional Measures to the Investment Program Approved by Belvodokanal GUP in the Field of Water Supply

The impact of risks should be taken into account in the course of implementation of the project. The risk assessment indicators are presented in Table 10.

The overall risk of the project is determined based on expert opinions. In this case three experts were selected:

1. Expert - the Director of the Institute of Management NIU "BelGU;"
2. Expert - the Consultant of the Department for Implementation and Monitoring of the Investment Programs of the Commission for the State Regulation of the Prices and Tariffs in the Belgorod Region;
3. Expert - the Consultant of the Department for Rationing of the Public Services and Energy Resources of the Investment Policy of the Fuel and Energy Balance Administration of the Commission on the State Regulation of Prices and Tariffs in the Belgorod Region.

Every expert assessed the risk indicators as the percentage on a scale of 0-75. The overall risk of the project is 68.48%. The following main risks have been identified: Attraction of foreign

**Table 8: Calculation of the payback period of the project**

Indicator	0 year	1 year	2 year	3 year	4 year
Net cash flow, billion rubles	-147.75	74.35	80.30	86.72	93.66
Cash flow by progressive total, billion rubles	-147.75	-73.4	6.898	93.618	187.27

**Table 9: The calculation of the discounted payback period of the project**

Indicator	0 year	1 year	2 year	3 year	4 year
Discounted cash flow, billion rubles	-147.75	61.96	55.76	50.18	45.2
Discounted cash flow by progressive total. bln. rubles	-147.75	-85.79	-30.03	20.15	65.35

**Table 10: The risk assessment indicators**

Simple risks	Experts			Average	Weight Wi	Assessment Ii
	1	2	3			
Attraction of foreign investments and domestic investors	32	37	29	32.67	1/5	6.53
The increase in the tax burden and bureaucratic obstacles	35	40	38	37.67	1/5	7.53
Rejection of loan provision to the lending institutions	32	30	35	32.33	1/5	6.47
Growing of the rates on loans	37	45	40	40.67	1/5	8.13
Solvency of the customers	15	15	20	16.67	1/5	3.33
Unforeseen costs	45	48	54	49	1/5	9.8
Late delivery of equipment and materials	35	35	35	35	1/5	7
Bad faith partners	15	15	10	13.33	1/5	2.67
The instability of demand	0	0	0	0	1/7	0
The emergence of similar services	0	0	0	0	1/7	0
The reduction of the prices by the competitors	0	0	0	0	1/7	0
Deterioration of water supply networks	50	50	60	53.33	1/3	17.77
Quality instability	0	10	15	8.33	1/3	2.78
The attitude of the local authorities	0	0	0	0	1/4	0
Tax increase	25	0	0	8.3	1/7	1.19
The overall risk of the project						73.2

investments and domestic investors, the increase in the tax burden and bureaucratic obstacles, rejection of loan provision to the lending institutions, growing of the rates on loans, solvency of the customers, unforeseen costs, deterioration of water supply networks. The calculation and feasibility study for the implementation of the additional measures to the investment program approved by Belvodokanal GUP for the construction, reconstruction, modernization and development of the centralized water supply systems, sanitation and purification of the wastewater of the city of Belgorod for the period from 2014 to 2018 confirmed the necessity of their implementation.

Table 11 shows the planned specific reduction in the consumption of the electric energy, as well as in the cost of energy resources in terms of implementation of the additional measures to the investment program approved by Belvodokanal GUP in the field of water supply.

Table 12 shows the planned specific reduction in the consumption of the electric energy, as well as in the cost of energy resources in terms of implementation of the additional measures to the investment program approved by Belvodokanal GUP in the field of water sewage.

As can be seen from the above, it is necessary, first, to reduce the key risks to attract foreign investment and domestic investors, to minimize the tax and bureaucratic obstacles, to provide actively the population and the companies with the loans, as well as to reduce the rates on the above-mentioned loans. The experience of the European Union in organization of the energy conservation requires a thorough study (Rulieva, 2010), especially their energy management standards (ISO 50001, 2012), energy audit standards, as well as the standards for energy service. These standards should be implemented as far as possible at the State Unitary Enterprise Belvodokanal GUP. The immutability of the budgetary

obligations of the state, departments, territories and municipalities on the energy supply of the buildings based on the indicators of the base year should be enshrined legislatively (by the example of the United States) for the period of 10 years. This will ensure the financial performance of the budgetary savings and allow to attract the significant funds from banks and investors in the projects of deep modernization of the budgetary buildings. The standard basic method of calculation of the cash savings for all types of investment projects in the field of public sector efficiency must be approved (by the example of Belarus). This will allow to reduce to the actual level the requirements to the professionalism of the existing energy auditing companies, as well as to monitor the effectiveness of the proposed projects on the basis of a comparison with the same baseline. The typical financial schemes of implementation of the investment projects in energy efficiency in the public sector of the RF (or region) must be approved in order to reduce the problem of preparation of investment projects for the banks to the choice from the number of standard solutions. The appropriate guidelines for the banks and municipalities should be prepared. The basis for the typical schemes should be the co-financing with the use of the central budgetary funds (payment of the interest on the loan), local budgetary funds (preparation of the project, design and estimate documentation, project implementation management and monitoring of project effectiveness), as well as the investors' funds and/or borrowings. A federal strategy for the modernization of public sector buildings with reduction of the energy consumption by 40-50% by 2030 must be created on the basis of the EU Directive 2010/30/EU (the directive of 2010 on the energy performance of the buildings). The main requirement for the existing and newly constructed buildings must be the compliance with the standard for the energy-passive building, i.e., the specific heat energy consumption should be of no more than 15 kWh per square meter per year. Based on the federal strategy and investment energy audits, the adequate regional and municipal modernization strategy must be

**Table 11: The planned specific reduction in the indicators in terms of implementation of the additional measures to the investment program approved by Belvodokanal GUP in the field of water supply**

Indicator	UM	Plan as of 2018		Deviation from the actual results as of 2014	
		City	Region	City	Region
Water raised	Million m <sup>3</sup>	46.19	6.100	0	0
Water supplied	Million m <sup>3</sup>	33.15	5.77	0	0
Unaccounted costs and water loss	Million m <sup>3</sup>	9.107	0.299	0	0
Specific energy consumption	kWh/m <sup>3</sup>	1.39	1.98	-0.16	-0.19
Cost price of 1 m <sup>3</sup> , of which for electricity	Rubles/m <sup>3</sup>	13.90	23.96	-0.90	-0.92
		5.79	8.60	-0.90	-0.92

**Table 12: The planned specific reduction in the indicators in terms of implementation of the additional measures to the investment program approved by Belvodokanal GUP in the field of water sewage**

Indicator	UM	Plan as of 2018		Deviation from the actual results as of 2014	
		City	Region	City	Region
Wastewater accepted	Million m <sup>3</sup>	31.480	2.947	0	0
Wastewater purified	Million m <sup>3</sup>	31.480	2.260	0	0
Specific energy consumption	kWh/m <sup>3</sup>	1.01	0.63	-0.25	-0.03
Cost price of 1 m <sup>3</sup> , of which for electricity	ruble/m <sup>3</sup>	10.30	16.57	-1.15	-0.12
		3.11	3.07	-1.15	-0.12



established, with the allocation of the 3-year periods of planning and the performance indicators, necessary to be achieved in the course of implementation of the 3-year plans and programs.

The following general conclusions can be drawn from the above: To reduce the costs on the energy consumed from 33.2% to 25.8% from the overall costs of the enterprise by 2018; methods of achievement of the objective: The upgrading/replacement of the equipment at the wells, WPS, CPS; the project result: The reduction of the energy costs for the enterprise. The requirements for the results: The reduction of the specific energy consumption: For water supply: City - by 0.16 kWh/m<sup>3</sup>, region - by 0.19 kWh/m<sup>3</sup>; for sanitation: City - by 0.25 kWh/m<sup>3</sup>; region - 0.03 kWh/m<sup>3</sup>. At least 39 variable frequency drives; not less than 140 pumps of all types must be installed. The users of the project results: Belvodokanal GUP.

## 5. CONCLUSION

The irrational use of the energy resources results in high energy consumption in the Belgorod region. The annual growth of the volume of fuel and energy consumption by the industry areas, as well as the annual increase in prices (tariffs) for energy, causes the high significance of the problem of energy saving and energy efficiency in our region. These issues are expected to be solved by the Federal Law of November 23, 2009 No. 261-FZ "On Energy Saving and Energy Efficiency Improvements and on Amendments to Certain Legislative Acts of the RF" (2009). The priority instrument for energy saving and energy efficiency management in the Belgorod region may be the program method, providing for the implementation of the targeted programs at the regional level as well as the other long-term programs, including the energy efficiency programs and energy efficiency of individual municipalities and businesses. According to the authors, the main way to solve the problems is the realization of highly efficient, fast, and no-cost energy saving and energy efficiency measures in the economy and social sphere of the Belgorod region, allowing to achieve quickly temporary improvement of individual indicators in the field of energy saving and energy efficiency.

The authors believe that Russian experts and representatives of the authorities should thoroughly study the experience of the European Union in the field of organization of energy saving, especially their energy management standards (ISO 50001, 2012), energy audit standards, energy service standards, ESCO. The implementation of these activities requires almost no financial expenditures. The water supply and sewerage systems of the city of Belgorod constitute a complex of buildings to provide the consumers with fresh water, drainage, sewerage and wastewater purification.

The implementation of the approved investment program for construction, reconstruction, modernization and development of the centralized systems of water supply, sewerage and waste water purification of the city of Belgorod is currently vital. However, the growth of tariffs for cold water supply and waste water intake is limited; the length of the networks and the significant deterioration of the equipment prevent the full implementation of the measures on modernization of the fixed assets, a large-scale reconstruction

of the networks and equipment is required, the implementation of which is often insufficiently financed. Since the energy saving is of high priority in terms of this study, based on the conducted energy audits, as well as the analysis of the condition of the power equipment, and in particular, of the pumping equipment of Belvodokanal GUP, the authors conclude, that at least 140 pumps of all types with the expired operation life must be replaced and at least 39 variable frequency pump drives must be installed as the additional measures to reduce the pressure in the water supply network (in case of impossibility of replacement of the pump or installation of the variable frequency drive), which is achieved through the trimming of the impeller and other technology solutions.

Based on the current cost of equipment, the total cost of the equipment and works on its replacement is 147.75 million rubles; the specific consumption of electrical energy per 1 m<sup>3</sup> according to preliminary estimates may be reduced:

- Water supply, city - by 11%
- Water supply, region - by 9.7%
- Sewerage, city - by 26.6%
- Sewerage, region - by 3.3%.

The estimated cost of processing and supply of 1m<sup>3</sup> of water should be reduced:

- Water supply, city - by 5.4% of which on electric energy - 13.5%;
- Water supply, region - by 3.3% of which on electric energy - 9.7%;
- Sewerage, city - by 9.54% of which on electric energy - 27%;
- Sewerage, region - by 0.65% of which on electric energy - 3.7%.

The overall estimated discounted payback period of the additional measures amounts to 2 years and 299 days. Based on the foregoing, the authors consider it necessary to reduce the main risks for the attraction of the foreign investment and domestic investors, to minimize the tax and bureaucratic obstacles, to provide actively the population and the companies with the loans, as well as to decrease the interest rates on the above loans in the course of implementation of the energy saving measures in any field of activity.

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