Cost Savings Calculations at a Moscow Sewage Station After the Installation of ARI Air Valves

The cost savings calculation is based on lowered head losses as a result of the installation and use of ARI air valves on the system. The results were gathered from tests that were performed over a period of time that reflected the changing working conditions at the pump station.
The use of the ARI Air Valves resulted in lowered head losses (h) measured in meters and was characteristic at all the pump stations that installed ARI Air Valves.

1. **Energy Savings measured during the first half of 2008 at specific pump stations using high-voltage pumps.**

   Energy savings in kWh for the first half of the year 2008 was calculated according to the formula:

   $$E = 2.72 \times h \times Q/0.7$$

   h = measured head loss savings
   Q = water volume 1000m3
   0.7 = pump and motor efficiency

   All calculations based on the rate of 0.7401 Rubles/kWh

N	Station	Q, x1000m^3	h,(m) Head loss saving	Energy Savings, kWh	Cost Savings Rubles
1	Brateevskaya	8793.0	2.1	71,751	53,103
2	Vychinskaya	12020.0	2.1	98,083	72,591
3	Lyblenskaya	45394.0	5.3	934,857	691,888
4	Novo-Kuncevskaya	23737.0	6.0	553,411	409,579
5	Novo-Solncevskaya	26697.2	6.0	622,426	460,657
6	Ramenskaya	11383.0	2.1	92,885	68,744
7	Savinskaya	54386.0	2.4	507,188	357,370
8	Tushinskaya	31289.0	2.4	291,792	215,955
9	Filevskaya	104834.0	5.4	2,199,717	1,628,011
10	Chapilovskaya	100129.0	5.6	2,178,807	1,612,535
11	Centralnaya	38913.0	4.8	725,783	537,152
12	Tcherkizovskaya	94706.0	5.6	2,060,803	1,525,200
13	Yugo-Vostochnaya	66301.0	5.1	1,313,896	972,414
	Total:	**618582.2**		**11,651,399**	**8,623,199**

2. **Cost Savings measured during the first half of 2008 at specific pump stations using low-voltage pumps.**

   Energy Savings in kWh for the first half of 2008 was measured according to the formula:

   $$E = 2.72 \times h \times Q/0.7$$

   h = measured head loss savings
   Q = water volume 1000m³
   0.7 = pump and motor savings

All calculations based on the rate of 1.7738 Rubles/kWh

N	Station	Q, x1000m^3	h,(m) Head loss saving	Energy Savings, kWh	Cost Savings, Rubles
1	Losevskaya	4871.5	2.5	86,180	48,585
2	Marinskaya	6329.8	2.5	106,889	60,260
3	Novo-Kozhuhovskaya	4280.2	2.4	68,836	38,807
4	Paveletckaya	3910.0	2.1	59,738	33,678
5	Severnoe Butovo	5492.6	3.8	145,751	82,169
6	Chorosheevskaya	2978.6	2.4	47,903	27,006
	Total:	**27862.7**		**515,297**	**290,505**

Total for 19 stations:	**646444.9**		**11,941,904**	**9,138,496**

Expected cost savings for one full year:
23,883,808 kWh 18,276,992 Rubles

Cost Savings Calculations at a Moscow Sewage Station After the Installation of ARI Hydraulic Check Valves

The cost savings calculation is based on lowered head losses as a result of the installation and use of ARI hydraulic check valves on the system. The results were gathered from tests that were performed over a period of time that reflected the changing working conditions at the pump station.

The use of the ARI Hydraulic Check Valves resulted in lowered head losses (h) = 0.9m

Energy savings in kWh for the first half of 2008 was measured according to the formula:

$$E = 2.72 \times h \times n \times Q/0.7$$

$$Q = \sum (Q_{PS} \times T_{iPump} / T_{total}) \times 1000 m^3$$

Q = water volume 1000m3
0.7 = pump and motor savings
n = number of check valves
T_{iPump} = work time of one pump during first half of year 2008

Q_{PS} = total flow at a particular pumping station

All calculations based on the rate of 0.7401 Rubles/kWh

N	Station	№, pump with check valve	Qps x 1000m^3	Q x 1000m^3	Number check valves	Energy Savings, kWh	Cost Savings, Rubles
1	Filevskaya	2, 7	104912.0	15658.10	2	109,517	81,054
2	Centralnaya	1-4, 6-9	38913.0	29779.50	8	833,145	616,611
3	Tcherkizovskaya	2, 4, 5, 8, 9	95606.0	42939.30	5	750,824	555,685
4	Yugo-Vostochnaya	1-8	66301.0	66301.00	8	1,854,913	1,372,821
	Total:		**305732.0**	**154667.90**	**23**	**3,548,399**	**2,626,171**

Expected cost savings for one full year:
7,096,798 kWh 5,252,342 Rubles

Actual Energy Savings Measurements With the Installation and Use of ARI Air Valves

Estimated pump energy savings is based on the total specific energy consumption (E) divided by the total volume of water (Q) for a specific time period, With and without the use of ARI Air Valves (U = E/Q).

To eliminate the influence of different work regimens of the pump station on the savings, a period of 7 days was used for the calculations.

Pump Station with High-Voltage Pumps

N	Station	period	E, kWh	Q x1000m^3	U, without air valves	period	E, kWh	Q x1000m^3	U, with air valves
1	Brateevskaya	01-07.03.08	68,720	360.0	190.89	09-15.03.08	77,290	423.0	182.72
2	Vychinskaya	01-07.03.08	44,301	485.0	91.34	09-15.03.08	40,009	481.0	83.18
3	Lyblenskaya	25-31.01.08	421,850	2208.0	191.06	02-08.02.08	346,893	2035.0	170.46
4	N-Kuncevskaya	23-29.02.08	308,372	1018.0	302.92	02-08.03.08	270,936	969.0	279.60
5	N-Solncevskaya	01-07.03.08	422,045	1144.5	368.76	09-15.03.08	449,569	1300.0	345.82
6	Ramenskaya	23-29.02.08	62,739	447.0	140.36	03-09.03.08	58,563	443.0	132.20

7	Savinskaya	25-31.01.08	236,863	2208.0	107.27	02-08.02.08	2245.0	2245.0	97.94
8	Tushinskaya	09-15.02.08	172,226	1180	145.95	18-24.02.08	1298.0	1298.0	136.69
9	Filevskaya	17-23.04.08	596,260	4096.0	145.57	24-30.04.08	3862.0	3862.0	124.60
10	Chapilovskaya	14-20.04.08	807,030	4699.0	171.71	22-28.04.08	3035.0	3035.0	149.99
11	Centralnaya	23-29.02.08	294,700	1617.0	182.25	03-09.03.08	1569.0	1569.0	163.59
12	Tcherkizovskaya	25-31.01.08	562,770	3324.0	169.31	03-09.02.08	3329.0	3329.0	147.75
13	Yugo-Vostochnaya	19-25.02.08	398,289	2832.0	140.64	27.02-04.03.08	2835.0	2835.0	120.82

Pump Station with Low-Voltage Pumps

N	Station	period	E, kWh	Q x1000m^3	U, without air valves	period	E, kWh	Q x1000m^3	U, with air valves
1	Losevskaya	21-27.03.08	14,977	199.7	75.00	01-07.04.08	12,756	195.4	65.28
2	Marinskaya	21-27.03.08	30,312	248.3	122.08	03-09.04.08	27,630	245.9	112.36
3	Novo-Kozhuhovskaya	01-07.04.08	17,850	174.1	102.53	11-17.04.08	16,320	175.1	93.20
4	Paveletckaya	15-21.04.08	22,473	150.0	149.82	23-29.03.08	21,674	153.0	141.66
5	Severnoe Butovo	16-22.04.08	45,388	197.6	229.70	23-29.03.08	43,200	201.0	214.93
6	Chorosheevskaya	13-19.04.08	16,100	114.4	140.73	24-30.03.08	16,294	124.0	131.40

The energy saving is calculated by the formula:

$$E_B = \Delta U \times Q$$

when: Q x1000m³ = total volume of water for the first half year 2008

and: $\Delta U = U_1 - U_2$

The cost savings is calculated according to the rate of 0.7401 Rubles/kWh for the pump stations with high-voltage pumps and 1.7738 Rubles/kWh for the pump stations with low-voltage pumps.

N	Station	Q, x1000m^3	ΔU kWh / x1000m^3	Energy Savings, kWh	Cost Savings, Rubles
1	Brateevskaya	8793.0	8.17	71,739	53,168
2	Vychinskaya	12020.0	8.16	98,083	72,591
3	Lyblenskaya	45394.0	20.60	935,116	692,079
4	Novo-Kuncevskaya	23737.0	23.32	553,547	409,680
5	Novo-Solncevskaya	27147.2	22.94	622,757	460,902
6	Ramenskaya	11383.0	8.16	92,885	68,744
7	Savinskaya	54386.0	9.33	507,421	357,542
8	Tushinskaya	31519.0	9.26	291,866	216,010
9	Filevskaya	104912.0	20.97	2,200,005	1,628,224
10	Chapilovskaya	100129.0	21.76	2,178,807	1,612,535
11	Centralnaya	38913.0	18.66	726,117	537,399
12	Tcherkizovskaya	95606.0	21.56	2,061,265	1,525,542
13	Yugo-Vostochnaya	66301.0	19.82	1,314,086	972,555
14	Losevskaya	4871.50	9.72	47,351	83,991
15	Marinskaya	6329.80	9.72	61,526	109,135
16	Novo-Kozhuhovskaya	4280.20	9.33	39,934	70,835
17	Paveletckaya	3910.00	8.16	31,906	56,595
18	Severnoe Butovo	5492.60	14.77	81,126	143,901
19	Chorosheevskaya	2978.60	9.33	27,790	49,294
	Total:	**648102.2**		**11,943,427**	**9,138,722**

Expected cost savings for one full year:

23,886,854 kWh 18,277,444 Rubles

Actual Energy Savings Calculation with the Installation and Use of ARI Hydraulic Check Valves

Estimated pump energy savings is based on the total specific energy consumption (E) divided by the total volume of water (Q) for a specific time period, With and without the use of ARI Hydraulic Check Valves (U = E/Q).

To eliminate the influence of different work regimens of the pump station on the savings, a period of 4 days was used for the calculations.

N	Station	period	E, kWh	Q x1000m^3	U_1, with check valves	period	E, kWh	Q x1000m^3	U_2, with ARI check valves
1	Filevskaya	27-30.08.07	323,240	2374.0	136.16	06-09.08.08	354,820	2652.0	133.79
2	Centralnaya	14-17.08.06	162,429	814.0	199.54	11-14.08.08	134,400	758.0	177.31
3	Tcherkizovskaya	14-17.08.06	406,980	2363.0	172.23	18-21.08.08	448,290	2735.0	163.91
4	Yugo-Vostochnaya	23-26.05.06	224,025	1572.0	142.51	11014.05.08	169,979	1518.0	111.98

The savings effect is calculated by the formula:

$$E_B = \Delta U \times Q$$

when: Q x1000m³ = total volume of water for the first half year 2008

and: $\Delta U = U_1 - U_2$

The cost savings is calculated according to the rate of 0.7401 Rubles/kWh for the pump stations with high-voltage pumps.

N	Station	Q, x1000m^3	ΔU kWh / x1000m^3	Energy Savings, kWh	Cost Savings, Rubles
1	Filevskaya	104912.0	2.37	248,641	184,019
2	Centralnaya	38913.0	22.23	865,036	640,213
3	Tcherkizovskaya	95606.0	8.32	795,442	588,707
4	Yugo-Vostochnaya	66301.0	30.53	2,024,170	1,498,088
	Total:	**305732.0**		**3,933,289**	**2,911,027**

Expected cost savings for one full year:

7,886,578 kWh 5,822,054 Rubles