SECTION # 6: KRASNOGORSK

Case Studies of Successful and Replicable Success Stories of Energy Efficiency Programs on the Municipal Level

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### SECTION # 6: KRASNOGORSK

| Population of 1.01.2001 – | 91,4 thou. people |
| City housing resources – | 1645 thou. m² |

**Official home page:**
http://krasnogorsk.woodwolf.ru

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1. **KRASNOGORSK**

In Krasnogorsk, Moscow Oblast, a municipal water supply renovation project was implemented. This project was implemented and funded by “Vodokanal” water utility. Through automation of remote control system and introduction of VSD electricity consumption per unit of pumped water was reduced on average by 17 percent. This lead to the fact that 20 percent increase of pumped water in 2000 as compared to 1997 was achieved at practically the same level of electricity consumption. The costs of municipal water supply dropped by 3.4 percent.

Brief project description is given in the table below.

**Table 9. BRIEF PROJECT DESCRIPTION**

<table>
<thead>
<tr>
<th>Brief Project Description:</th>
<th>Automation of Remote Control System in Joint-stock Company “Vodokanal” (Krasnogorsk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Replacement of the obsolete remote control system with a modern one, based on computerized tools, controllers and special software</td>
</tr>
<tr>
<td></td>
<td>Installation of variable speed drives at pumping plants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sponsor</th>
<th>Partners (if any):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>OAO “Vodokanal”</td>
</tr>
<tr>
<td>Status</td>
<td>Joint-stock company</td>
</tr>
<tr>
<td>Contact person:</td>
<td>V.P. Kurbatov, Chief Energy Manager</td>
</tr>
<tr>
<td>Address:</td>
<td>3, Rechnaya St., Krasnogorsk, Moscow Oblast, 143400, Russia</td>
</tr>
<tr>
<td>Tel.:</td>
<td>(7-095) 562-03-26</td>
</tr>
<tr>
<td>Fax:</td>
<td>(7-095) 562-00-63</td>
</tr>
<tr>
<td>Country: Russia</td>
<td>Region: Moscow Oblast</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Project targets:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency project</td>
</tr>
<tr>
<td>District heating reform</td>
</tr>
<tr>
<td>Water utilities reform</td>
</tr>
</tbody>
</table>

**EFFECT:** Reduction of water utility’s costs – electricity savings; reduction of network damages

<table>
<thead>
<tr>
<th>Sources of financing (thou. USD):</th>
<th>Type of external financing:</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Vodokanal” own funds 158.6</td>
<td>loan ☑</td>
</tr>
<tr>
<td>Other</td>
<td>equity ◇</td>
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</table>

**Project schedule**

<table>
<thead>
<tr>
<th>Program lifetime:</th>
<th>20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program implementation time:</td>
<td>48 months</td>
</tr>
<tr>
<td>Program start-up:</td>
<td>1997 (day/month/year)</td>
</tr>
</tbody>
</table>

**PROJECT SUCCESS CRITERIA:**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Before the project</th>
<th>After the project</th>
<th>Savings</th>
<th>Share, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific electricity consumption for water extraction, kWh/m³</td>
<td>1.1537</td>
<td>0.9594</td>
<td>0.19</td>
<td>17%</td>
</tr>
<tr>
<td>Total electricity consumption, thou. kWh</td>
<td>12771.5</td>
<td>12756.7</td>
<td>14.8</td>
<td>0.1%</td>
</tr>
<tr>
<td>Information: water extraction, thou. m³</td>
<td>11069.6</td>
<td>13296.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of water-supply network damages</td>
<td>203</td>
<td>145 (1999)</td>
<td>95</td>
<td>28.6</td>
</tr>
<tr>
<td>Cost of damaged pipes replacement, thou. Rbl per year</td>
<td>331</td>
<td>236</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>
1.1. Project description

Before the economic reform, “Vodokanal” water utility was a public organization. Later on it turned into a rented company, and then into a joint stock company. This change of status was a motivation for an analysis of production costs and search for minimization methods.

Water supply and distribution in “Vodokanal” (Krasnogorsk and Krasnogorsk district of Moscow Oblast) includes 13 pumping plants supplying water from water wells to the municipal network. Each pumping plant has pumps of the first tier to pump water from water wells to storage tanks, and pumps of the second tier to supply water from storage tanks to the network. For buildings higher than 9 floors, there are pumps of the third tier. Water supply networks in the city are connected. Water pumping plants differ in capacity, altitude drop amounts to 65 meters; therefore plants have different impacts on the network. It is a difficult challenge to ensure rational functioning of the water supply system, having no access to information on the work of all pumping plants.

Previously, relay remote control was installed at “Vodokanal” dispatch, so that the dispatcher could monitor the amount of water in storage tanks and the work of pumps. This system was installed as long ago as 1980, could not provide enough data, its reliability was decreasing from year to year, whereas maintenance costs kept growing.
In 1996, the “Vodokanal” management made a decision to replace this remote control system with a more up-to-date one. In 1997, KomAS company designed a new remote control system for “Vodokanal” (Krasnogorsk) and accomplished phase 1 of installation work at the dispatcher’s. The new remote control system incorporated the largest water wells: No. 1, 7, 9, and 11. In 1998, phase 2 of the project was accomplished: water wells No. 2, 3, and 4, and one pump of the third tier were incorporated. Water wells No. 8 (1997), and No. 10 (2000) were automated; and a control point was placed at a pump of the third tier (Yuzhny district).

The project was financed by “Vodokanal”. KomAS company was responsible for the technical guidance; equipment delivery, software, and consulting was provided by DEP company. Installation and adjustment was accomplished by control and metering equipment service of “Vodokanal”. This service also adjusted relevant software. The project costs amounted to 4.6 million rubles (in 2001 prices). Annual benefits equal 1.1 million rubles (in current prices – 0.44 rubles/kWh).

The new system allows for permanent control over all pumping plants by looking at water pressure, water consumption and water store in the city. Any minute dispatcher can have complete control over all pumping plants and change their operation parameters by switching on/off relevant equipment. The software allows for retrospective information control (up to 400 days back) in the form of curves, charts, etc., which allows for equipment operation analysis and projections for various scenarios. There is also a possibility for technical and economic control (water and electricity consumption).

In 2000, control and metering equipment service was assigned a task of transition to programmable controllers for the sake of automation control over pumping plants. Based on the water level in storage tanks, controller regulates the work of pumps. Frequency converters, also regulated by the controller, are incorporated in the rotary pumps control layout (pumping plants of the first and second tiers). By changing parameters of frequency converters, “daytime” and “nighttime” pressure in the network is ensured. There are plans of frequency converters installation at some other pumping plants of the third tier.

Introduction of remote control automation system provides:

- Complete information on pumping plants operation;
- A possibility of quick adjustment of pumping plants operation for the sake of reliable water supply;
- A possibility of emergency and “pre-emergency” situations analysis and handling;
- Optimum water pressure in the water supply network;
- Reduction of emergencies in water pipes operation through stabilization of water pressure and removing water hammers. Installation of frequency converters allowed for a 33 percent reduction of water pipes breaks in 1999-2000, as compared to 1998;
- Reduction of electricity consumption through bringing down “nighttime” pressure from 5.5 to 3.6 atmospheres, and a possibility to increase the pump productivity by 2.5 percent. For example, installation of a frequency converter at VZU-7 allowed for a 30 percent reduction of electricity consumption.

Introduction of remote control automation system and frequency converters allowed for electricity consumption reduction. Reduction of specific electricity consumption is shown in the chart below.
1.2. Problems

Imperfect tariff design system is the major problem. Tariff for water supplied by “Vodokanal” is regulated by the local administration. Current regulation system provides no motivation for suppliers to reduce production costs and improve energy efficiency. Major drawbacks of the regulation systems are as follows:

- Lack of formal and transparent decision-making in tariff regulation, and consequently, high policy determination of this process;
- Tariff design based on the production costs analysis; however, tariffs are designed based on the last year costs, with no focus on costs reduction, or reimbursement of project costs;
- Lack of tariff validity period, as well as obligatory conditions for its re-design;
- Misbalanced tariff regulation at various levels, i.e. electricity costs increase is not necessarily followed by adequate water tariff increase. This is a reason for direct utility losses.

As a result, a utility is interested in the increase, rather than reduction, of costs. Such approach “kills” motivation for energy efficiency projects, because does not provide a mechanism for getting back project costs through generated revenues.

2. DISSEMINATION OF SUCCESS PRACTICES TO IMPLEMENT ENERGY EFFICIENCY PROGRAMS IN OTHER RUSSIA’S CITIES

Success practices of municipal energy efficiency programs and projects may be disseminated in other cities of the Russian Federation. Below is an analysis of possibilities to disseminate certain priorities of successful energy efficiency practices.
2.1. **Heat and water utilities restructuring**

Of the above case studies, “Vodokanal” has the most successful restructuring experience. Krasnogorsk “Vodokanal” was transformed from a state enterprise into a joint stock company, and then provided its own financing for an energy efficiency project.

Things are much more complicated with heat utilities restructuring, because, until recently, they had been heavily dependent on public financing (the share of residential payments only amounted to 30-40 percent). Delays in public funds transfer resulted in growing debt to fuel suppliers.

“Mtyishchinskaya Teploset” may serve a negative restructuring example. In early 90’es it turned from a federal into a rented company, and then into a joint stock company. Stakeholders owned non-energy equipment. Energy equipment (boiler-houses and central heating points), in accordance with the legislation in force, remained in the federal ownership, and was only managed by “Mtyishchinskaya Teploset”. Having changed the status, the company started to develop new productions: heat-, water-, and gas meters; block automated individual heating points; pre-insulated pipelines; boilers; mini-boiler-houses; and mini-cogeneration plants. It became a holding company.

However, in late 90’es the company had a considerable debt to AO “Mezhregiongas” (primarily, for delay in public funds transfer). A bankruptcy danger became somewhat real. Therefore, in 2000, “Mtyishchinskaya Teploset” (part of a holding) turned back from a joint stock company into a municipal unitary enterprise, which allowed it to stabilize the financial situation in the company, at the same time keeping side-productions as separate companies.

Nevertheless, while the share of residential payments in covering heat supply costs is growing, and after the Budget Codes was enforced, situation becomes more favorable for heat utilities restructuring.

2.2. **Improving tariff regulation**

At the final workshop under “Review of public expenses for communal services” project, which took place in July 2001, tariff regulation practices in Cherepovets were highly appreciated.

In most regions, tariff design practices to not motivate utilities to reduce their costs and attract investments. In Cherepovets, a tariff design entity was set up (Working Group); tariff approval procedure was made transparent; and the volume of information required to backup tariff increase was identified.

In Cherepovets, demand and consumption charges were introduced for water and heat; a program of residential electricity tariffs depending on the time of day is developed. Besides, separation of network charge in the structure of communal services allowed for a more differentiated accounting of all utility costs, and stabilization of cash flows.

Cherepovets has tested a totally new approach to tariff regulation, regarding this not as a way to limit profits of a natural monopoly, but rather as a way to accumulate funds to finance projects aimed at improvement of municipal heat- and water supply.

Such tariff regulation procedure was implemented at the local water utility and resulted in large-scale replacement of water pipelines; construction of new water treatment facilities; installation and maintenance of water meters at all public buildings in the city; regular analysis of water consumption by each public building; development of repair and renovation plans for in-house water supply systems; replacement of water taps and lavatory pans in buildings where water consumption is higher than identified in the standards.
2.2.1. Providing energy resources consumption control

Energy resources consumption control is an important condition for energy payments. Energy consumption control helps get a real picture of energy resource consumption by a facility.

RESOURCE CONSUMPTION CONTROL IN BUILDINGS

Installation of energy meters is included in practically all municipal energy efficiency programs. Apparently, in all cities, heat- and water meters are installed (or are being installed) in public buildings.

However, the situation in the residential sector is somewhat different. First, financing is not there yet (and it seems like considerable investments will be needed, if residents are to cover 100 percent of communal costs, since the budget can no longer afford sponsorship). Second, after installation of energy meters in some cities, it turned out that the amount of heat and water supplied to houses for heating purposes was actually bigger, than required by standards.

Cherepovets experience can serve an example. Water meters are installed in all buildings owned by the municipality, and perform the function of technology control over consumption. Heat metering is done in 40 percent of public buildings and 8 percent of residential buildings. However, the Tariff Design Working Group does not recommend using energy meters for commercial purposes, because it believes that at this point it is important to remove technical factors determining water over-consumption. Analysis of metered heat- and water consumption data is actively used for the development of specific recommendations in terms of tariff regulation (see above for a description of these efforts and achieved results).

Cherepovets experience is of special importance because the municipality does not blindfold follow the market policy, but rather keeps to the policy of tough control and regulation, affecting tariff design, regulations, investments, so as to bring municipal resource supply system to the design values. Only afterwards can market mechanisms work.

INDIVIDUAL HEAT- AND WATER CONSUMPTION CONTROL

Individual heat- and water consumption control (in flats) in the above cities is voluntary. The legislation base for individual heat- and water consumption control is rather weak. “Heat- and Heat Carrier Consumption Regulations” (Moscow, 1995) do not regulate the relations between residents, heat utility, and the company responsible for meters maintenance. Therefore, First deputy mayor of Dubna signed an executive order to adopt Temporary Rules for Using Heat Meters, which define rights and obligations of residents, who have individual heat meters; how residents must pay for heat, should the meter go out of order; and how communal subsidies may be received. At the same time, Mytishchi is successfully introducing individual consumption control without adopting additional regulations.

In many Russia’s cities, mayors’ executive orders adopt tariffs for residents, who at their own expense install hot and cold water meters in their flats. Residents are to put in an application addressed to heat and water supply companies, in order to make official acceptance of meters. These residents get special checkbooks, fill in data on hot and cold water consumption, and pay those checks in the bank (similarly to how they pay electricity bills, before 10th date of the next month). Public subsidies are calculated based on the consumption norms. For extra-consumption residents have to cover 100 percent of costs.

Meters’ readings verification is different in different cities. In Dubna, it obligatorily takes place twice a year; in Mytishchi either by residents’ requests, or spot checks are organized. Access of technical personnel to flats is the major problem in this connection.
2.2.2. Promotion of competition

Promotion of market mechanisms in the housing sector is based on two global ideas:

- Elimination of federal (municipal) monopoly for housing stock through privatization and setting up unions of housing owners (UHO);
- Development of professional competitive management of the housing stock.

Setting up UHO

UHO are slowly developing in Russia’s regions. Their share in the housing stock of the above success stories does not exceed 3 percent. The highest index is in Cherepovets.

Institute of urban economics foundation identifies two major reasons determining slow rate of UHO creation in Russia:

- Psychological barrier: residents do not want to take upon themselves responsibility for housing stock maintenance, passing it over to the local authorities, following the usual practice;
- Local authorities do not want to leave property management to residents, because it is performed on a commercial basis.

Separation of management and maintenance functions is a starting point for market relations. However, in most municipalities, executive authorities are not only interested in competition in the communal services market, but even are eager to monopolize this market and bring it under its complete financial and management control.

Promoting competition in public buildings maintenance

Cherepovets example is a success story in terms of market development policy in the communal services. Administrative and commercial functions here are clearly separated. Cherepovets budget allocates funds for renovation of heat- and water supply of public buildings, and street lighting; tenders are announced to identify contractors for these works. To promote competition among tenders participants, the municipality inspires setting up various managing companies and ESCOs to act as general contractor. Six ESCOs are operating in the city, one of them is actively working with the Education department of the city administration.

Municipal dispatch company in Dubna is a special experience. This company is responsible for the maintenance of social and culture facilities; “passportization” of buildings; energy audits; energy efficiency projects development; installation of heat meters and water meters; development of feasibility plans; performing the functions of a general contractor for construction, repair, and renovation of public buildings; and analysis of energy supply contracts between public buildings and utilities. Municipal dispatch service receives funds from the municipal budget for new construction, and renovation, maintenance, capital and current repairs of old facilities, and announces tenders to identify subcontractors, signs contracts with them and releases payments for accomplished work.

Promotion of competition in residential buildings maintenance

Unfortunately, it is too early to speak about competition in the maintenance of residential buildings. For example, in Cherepovets, there is municipal dispatch service, and tenders for maintenance of residential buildings were announced, but so far maintenance means only the technical aspect, i.e. cleaning, scavenging, elevators, and does not focus on communal costs minimization. Like in many other Russian cities, in Dubna maintenance of residential buildings is performed by organizations,
which at the same time are responsible for management; in other words, there is no separation of functions.

Tenders for renovation of engineering systems in public buildings, promotion of UHO approach, development of competition in the maintenance of residential and public buildings must become elements of the developing market in the housing and communal sectors of other Russia’s cities.

2.3. Public subsidies restructuring

For most Russia’s regions, federal requirement of transition to a new system of housing and communal payments has become a serious challenge. Regional and municipal authorities had to either increase the share of housing and communal costs covered by residents up to 80 percent in 2001, which is a very unpopular measure and dangerous of people’s discontent, or keep this share at the current level and subsidize communal costs from the regional/municipal budget. This last option must be followed by thorough tracing subsidies, so they are allocated for the needy families only.

Finding a compromise between the interests of people and energy utilities is becoming a very important challenge, because tariff regulation tools are in the hands of local administrations. In a number of cities, compliance with the federal standards was achieved at the expense of energy utilities. Many city mayors, according to Konstantin Shreiber, deputy minister of communal services, fuel, and energy of Moscow Oblast, pursue tariff policies, which “not only provide no motivation for energy efficiency, but directly eliminate the heating sector in place”. In only 7 of 73 cities of Moscow Oblast tariffs are higher than production costs. The situation in other Russia’s cities is similar. Under these circumstances, there is hardly a chance of loans, investments, or participation in federal programs.

To handle this situation, Cherepovets experience seems useful and worth to be disseminated. Cherepovets has accomplished a transition to 100 percent coverage of communal costs by residents, thus avoiding indirect subsidies to cover the difference between utilities’ tariffs and residential tariffs, and cross-subsidies. At the same time, direct subsidies to people, whose housing and communal payments exceed 20 percent of the family income, are allocated according to the federal standard. Importantly, in Cherepovets this share is lower, than prescribed by the federal standard, i.e. subsidies are paid to more families, ensuring social security of the needy families.

2.4. “Passportization” of municipal facilities

To have an adequate picture of residential buildings, boiler-houses, water-, heat-, and electricity networks, in practically all Russia’s cities it is important to take certain efforts to restore and process primary data and data required for monitoring of current status of these facilities. Such work is taking place in Cherepovets, Dubna, Irkutsk, and other cities.

In different cities this work is organized differently. As a rule, it is done by municipal heat-, water-, and power utilities and housing maintenance organizations. In Cherepovets, “passportization” of engineering systems of residential buildings is done by municipal organization (design institution) Cherepovetsproekt in the course of energy audits. In Dubna, this work is done by municipal dispatch service.

Cherepovets has made a step forward in terms of inventory effort and energy “passportization”. It has launched a project aimed at compilation of a computer-operated electronic information complex with a GIS platform and an ORACIL database for energy parameters of municipal facilities.
2.5. Setting up energy efficiency funds

In many Russia’s cities, energy efficiency funds have been set up. However, not all of them are working efficiently. Some face difficulties with the development of a monitoring mechanism and a mechanism of accumulation of financial savings (their return to the fund’s account). Low payment discipline is another barrier to their success, especially if budget savings are involved.

Kirovsk energy efficiency fund seems to be quite successful, although has some problems. In Dubna, an “energy efficiency” bank account was opened. In Cherepovets, financing for energy efficiency projects is found through tariff regulation.

2.6. Implementation of energy efficiency projects

In most Russia’s cities energy efficiency projects have been, or are being, implemented. Such measures as introduction of automated energy consumption control and regulation (Krasnogorsk Vodokanal), installation of individual heating points (Irkutsk), and other regulation equipment in residential buildings (Dubna), and public buildings (Kirovsk), turned out quite successful. All energy efficiency projects had a positive effect.

However, analysis of implemented projects revealed a number of problems:

1. Tariff regulation in a number of cities primarily aims at the minimization of municipal expenses. Profitability regulation method is applied. Price is identified based on the economic costs; therefore, enterprises are not motivated to reduce costs and improve the efficiency of production. Moreover, inflation often leads to a lag between a change in the economic situation and a tariff review, which also brings achieved savings to nothing.

2. After a ruble to U.S. dollar drop, a number of projects lost their economic attractiveness. The energy saving effect in the international currency by current exchange rate, does not provide acceptable payback periods.

3. Most demonstration projects were financed with the involvement of foreign capital, which had an impact on their scopes of work. They suggested “excessive” and pretty costly technical solutions, which is now a barrier to their replication in other municipal facilities and other cities.

4. While it is important to motivate residents to reduce communal costs, projects implemented in residential houses do not involve residents in the decision-making process, or in the financing of energy efficiency measures. Control of heat consumption for heating purposes leads to a growing number of residents’ complaints of low indoor air temperature, given lack of elementary weatherization measures (Irkutsk). In Dubna, for example, the costs of check and replacement of control and metering equipment in a residential building are covered by the maintenance organization, rather than on residents who use this equipment.

5. There is no solution to the problem of reduction of residential payments for communal services, if the quality of these services is low. For example, in Dubna, DHW payments kept stable even after the temperature of supplied water dropped to 35°C.

3. CONCLUSION

In spite of the financial crisis of 1998 and relatively low heat, water, and power tariffs, Russian municipalities are going on with energy efficiency programs and projects.
Some of the above municipal success stories include a number of components which are worth disseminating in other Russian cities, for example, energy “passportization” of municipal facilities; water and energy consumption control; public subsidies restructuring; efficient regulation of natural monopolies’ tariff design practices; setting up energy efficiency funds; etc. Practical experience in these areas and specifically developed legislation and regulations may provide a good basis for municipalities, which are yet not that successful in energy efficiency programs.

In the course of programs (projects) implementation, certain barriers were identified. Information on these barriers would allow avoiding and/or handling these problems in other cities. At this point, a database of municipal success stories is being developed and will be available from CENEf website. We hope that this information will be of interest to municipalities who have plans for energy efficiency programs, and those which are facing similar problems in the course of such programs implementation.