



The 50-year anniversary!

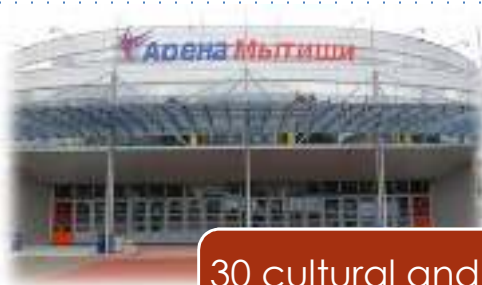
Mytishchi
Teploset JSC



1969



Mytishchi Teploset JSC today



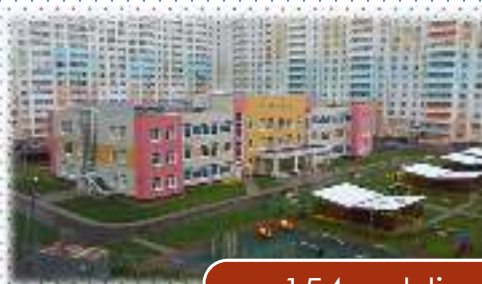
30 cultural and sports facilities

More than 200,000 citizens using centralized heat supply



1,201 residential houses

1,800 buildings in the urban district Mytishchi are connected to the central municipal heating



154 public education facilities

359 other facilities



56 healthcare facilities



Mytishchi Teploset JSC today

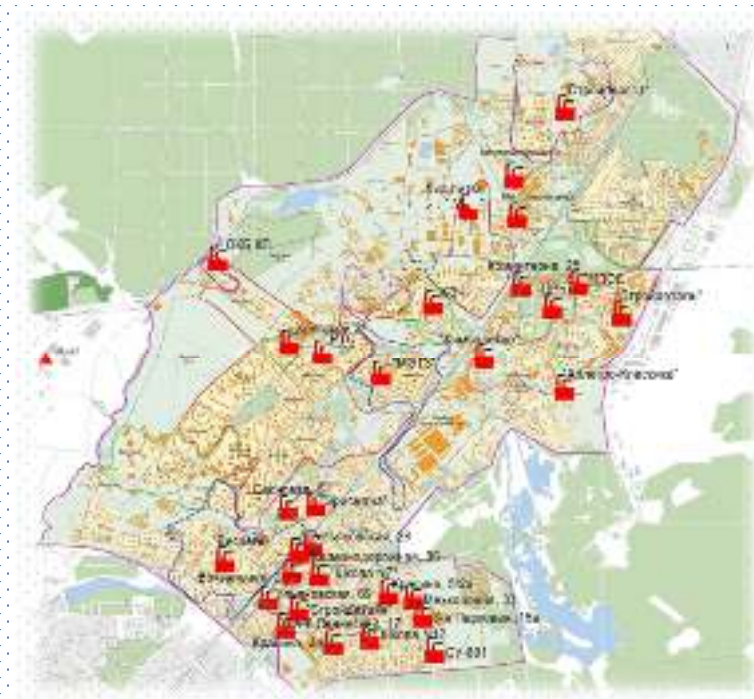
Mytishchi Teploset JSC operates:

- **48** heating sources with the total set capacity **1,078.5** MW.
- **274 km** of heating networks
- **9** central heat supply stations
- **1,353** individual heating stations
- **1** water-intake facility

Annual average energy resources consumption:

- **Gas** - 200 mln m³
- **Water** – 240,000 m³
- **Diesel fuel oil** – 220 tons
- **Electric power** - 30 mln kW
- **Residual fuel for reserve fuel facility** – 3,000 tons

Average annual heat generation: **1,832,000** MW



Development of the energy-efficient municipal heat supply system in Mytishchi urban district



The heat supply system in Mytishchi had been built in the 1950-60s, and by the year 2000 the service period of heat supply facilities more 50 years, with more than 80% wear.

Incidents occurred in the heating networks during the heating season, threatening destruction of domestic utility heating and hot water supply networks of residential houses as well as social infrastructure institutions.



implementation of the new heat supply system: removing the central heat supply station and installing an individual heat supply station at each heat consumption facility for eliminating internal hot water systems

automation of the regulation process of heat energy supply for the facilities, depending on changes of the outdoor temperature for each building, of precise regulation of hot water temperature.

reduction of energy costs (gas, electric power, water) for generation and use of the heat energy unit

reduction of heat losses within networks and in each building

reduction of periods of hot water cutout for system preventive maintenance down to 3 days

Complex project
of the heat supply
system
reconstruction

development of the unified center of the heat supply system with control processes automation

increasing reliability and safety of the heat supply system

Providing cost-effective use of resources by consumers: development of an individual regulation system in each building, in each house, in each water-intake unit

Complex project of heat supply system reconstruction, 2000-2018

Project description

In order to achieve these objectives, a long-term program of heat supply system modernization in the Mytishchi urban district for 2000-2020 was launched.

The complete program of heat supply system reconstruction in the Mytishchi urban district included:

Stage 1

- Installing 1,000 individual heat supply stations to regulate heating temperature depending on the outer temperature both within the building and individually for it, as well as to precisely regulate hot water temperature depending on water intake and reduction of general household expenses.
- Replacing 200 km of the heating networks to reduce heat losses and electric power, gas and water expenses for heat carrier generation. Reducing the amount of repair works, ensuring safety of the heat supply system in the urban district.

Stage 2

- reconstructing 28 heat sources and their unification into single network to reduce costs per unit of gas, electric power and water for heat carrier generation and ensuring complete automation and safe operation.

Stage 3

- Full automation of technical processes of the heat supply system of the Mytishchi urban district
- complete dispatching of heat sources, heating networks and regulation units with the development of the artificial intelligence of the district heat supply system, including generation and release of heat energy to houses and apartments of the citizens and organization of online payments for the heat energy.
- further system development, enabling to take readings and make calculations regarding heating in the on-line mode.





Complex project of heat supply system reconstruction 2000-2018

Sources of project funding

It is impossible to solve the issues of heat supply systems modernization and reconstruction without funds raising, since heat energy cost is a regulated value.

Heat supply systems was modernized using borrowed funds of the World Bank:

- from 2003 till 2018 – credit resources of the International Bank for Reconstruction and Development (IBRD),
- from 2009 till 2018 – credit resources of the International Financial Corporation (IFC).

In the 2000s the World Bank Group was implementing 2 communal household projects in Russia. Within of one of them – “Municipal heat supply” – the financial institution provided funds for recovery of the systems (repair and replacement of some sections of the heat supply systems, improvement of fitting of such sections with modern and more effective technologies); technical assistance (procurement, project works and supervision), as well as support in general development of the centralized heat supply systems and public utility services through researches in the key areas of industry.

In order to take part in the World Bank’s project, it was necessary to provide a justification and participate in the competition. Ultimately 8 cities took part in the project: Tambov, Krasnoyarsk, Kazan, Volgograd, Syzran, Neryungri, Mytishchi and Dubna. Credits were allocated against guarantees of the Russian Federation and the Moscow region for the effective investments and their return.

Mytishchi heating network fulfilled all requirements set by the World Bank. According to the results of implementation of “Municipal heat supply” project, the International Rating Agency highly evaluated the ability of the Mytishchi urban district to fulfill its debt obligations in the Russian financial market conditions in a timely and complete way. This, in its turn, opened new opportunities of reconstruction funding.

The issue was solved regarding raising credit funds from the International Financial Corporation (being a part of the World Bank Group) for further reconstruction of the heating networks and construction of the individual heat supply stations for the period from 2009 till 2017.





Complex project of heat supply system reconstruction 2000-2018

Conditions of credits extension by IBRD 2003-2018

- ❑ Implementation period: 5 years during which the borrower is released from credit payments (principal debt)
- ❑ Payment of principal debt: 15 years
- ❑ Interest rate: LIBOR, floating
- ❑ Margin of the Russian Ministry of Finance - 2 % (const)
- ❑ Commitment fee: 0.25 %
- ❑ Availability of approved feasibility study
- ❑ Local costs: 10-50 % of the credit amount
- ❑ Project profitability: internal rate of return (financial activity) – at least 10%, internal rate of return (economic activity) – at least 20%
- ❑ procedures – purchase of goods (works, services) through classic procedure of the World Bank – holding a tender
- ❑ Availability of report on credit rating assignment to the Administration of the Mytishchi urban district – the borrowers' status
- ❑ Entry into force of the Subloan Agreement
- ❑ Guarantees (suretyship) of the Moscow region Government
- ❑ Establishment of the Local Project Management Office
- ❑ Opening of the local co-funding account

Types of works	Total	Periods and scopes of servicing and repayment of subloan of IBRD, 2003 – 2018 *		
		Payment, %	Principal debt repayment (Subloan)	Total
Heating networks replacement	54.2 line km	4 042 726.94 Euro/ 140 201 770.50 RUB	16 159 781.38 Euro/ 560 421 218.28 RUB	20 202 508,32 Euro/ 700 622 988,77 RUB.
IHSS installation	236 units			

* Average annual exchange rate of CB in 2003: 34.68 RUB for 1 Euro

Conditions of credits extension by IFC 2009-2018

- ❑ Period of credit tranche A – 6 years (June 2009 – June 2015)
- ❑ Period of credit tranche B – 7 years (April 2011 – December 2017)
- ❑ Credit amount - 450.00 mln RUB
- ❑ Credit disbursement period – 4 years (2009 – 2012)
- ❑ Grace period for principal debt repayment in each tranche – 3 years (June 2009-June 2012)
- ❑ Credit payment period – 5.5 years (June 2012 – December 2017)
- ❑ Credit rate – MosPrime
- ❑ IFC margin – 3.85 %
- ❑ Commitment fee – 0.5% - 1% per annum
- ❑ Project payback period – 8 years
- ❑ security – municipality guarantee

Types of works	Total	Periods and scopes of servicing and repayment of subloan of IFC, 2009 – 2018 *		
		Payment, %	Principal debt repayment (Subloan)	Total
Heating networks replacement	11,5 line km	4 706 882.97 Euro/ 207 997 158.78 RUB	10 183 299.38 Euro/ 450 000 000.00 RUB	14 890 182.36 Euro/ 657 997 158,78 RUB
IHSS installation	158 units			

** Average annual exchange rate of CB in 2009: 44.19 RUB for 1 Euro

Complex project of heat supply system reconstruction 2000-2018

The results of the heat supply system modernization in 2000-2018



A fundamentally new closed central heat supply system was constructed.

IHSS installed – 1,000 units

Heating networks replaced – 200 km



Fitting of budgetary organizations with metering instruments – 100%

Fitting of multi-apartment houses with heat energy meters – 80%

All the facilities of the centralized heat supply system are included into the automated system of dispatch control, process and financial metering. This ensures transparency in the settlements with consumers, since the residents can pay for used heat resources, and also see heat energy consumption across the whole house almost for any period, as well as initiate reduced heat energy consumption by the whole house and by each individual family.



Creation of foundation for further development of the heat supply system.

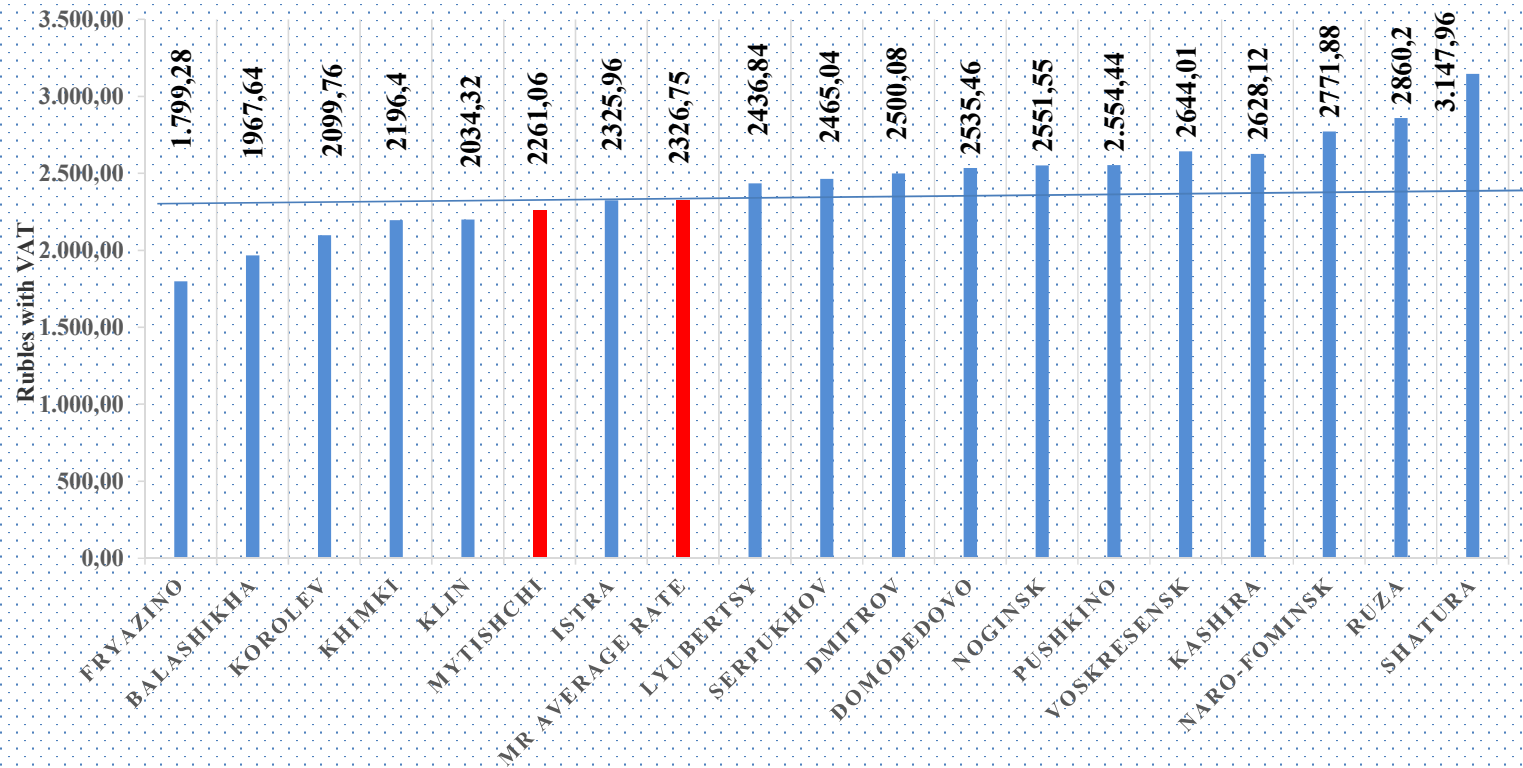
Mytishchi Teploset JSC, Mytishchi city, Moscow region, Russian Federation

Energy efficiency indicators achieved after performance of actions within modernization of the district heat supply system during 2000-2020



Indicators	2000	2019	$\Delta(2000/2019)$
Number of citizens' inquiries in regard to technical issues and incidents, annually	703	134	Reduction by 81 %
Number of incidents per 100 km/year	194	61	Reduction by 69 %
Specific reference fuel consumption (gas), kg/Gcal	192.89	159.01	Reduction by 17.6 %
Specific electric power consumption, kW•h/Gcal	41.6	20,8	Reduction by 50 %
Specific heat carrier consumption in the system, m3/Gcal	1,5	0.1	Reduction by 93.4 %
Losses in the heat networks, %	31	5.2	Reduction by 83.3 %

Analysis of heat energy rates in the Moscow region in 2019



Cities of the Moscow region

Heat energy rate in the Mytishchi urban district is the average rate across the Moscow region

- heat energy rate in the Mytishchi urban district – 2,261.06 rubles with VAT
- average heat energy rate in the Moscow region – 2,326,75 rubles with VAT



Modernization of the heat supply system through concession agreement



To improve the quality of provided heat supply services in the Mytishchi urban district, it is necessary to keep on reconstructing the heat supply system in accordance with the reconstruction plan for 2000-2020.

The key tool for implementing federal and regional programs of housing and utilities services improvement, increase of reliability and efficiency of the heat supply systems in Russia is to execute of the concession agreement in accordance with the Federal Law “On concession agreements” 115-ФЗ dated 21.07.2005

In 2018, Mytishchi Teploset JSC executed concession agreement for the period of 27 years. The concession agreement project stipulates modernization and technical refitting of the equipment in the boiler houses, relaying of heating lines, installation of metering and regulation units, as well as documenting of reconstructed and newly created property by the concessioner and its transfer into municipal ownership.

The total expenses for the project implementation with account of the borrowed funds will amount to 3 bln rubles, including VAT. RF Sberbank acts as the creditor, and according to the loan conditions the borrower shall pay interest on credit to the creditor in the credit currency under the floating interest rate determined according to the effective key rate of the Bank of Russia (floating part) plus 2.5 (two point five) percent per annum (“fixed margin”). As of 01.06.2019, the effective key rate of the Bank of Russia is 7.75 %. Therefore, current credit interest rate amounts to $7.75 \% + 2.5 \% = 10.25 \%$

The following actions are planed within the frames of the concession agreement :

Plans by 2020:

- replacement of the heating networks – 100%
- installation of metering and regulation units – 100 %

Plans by 2025:

- reconstruction of the heat sources -100 %
- complete automation of all technical and financial processes
- development of artificial intelligence in the heat supply system

Actions	Scope
Modernization of existing boiler houses	10 units
Construction of boiler houses	4 units
Modernization of heating networks	18,8 line km
Installation of heating and hot water regulation units (IHSS)	250 units



Environmental projects as a tool for effective energy resources use

Project relevance

Each year about 20 000 tons (80 000 m³) of wood wastes of the 4th and 5th hazard class are formed on the territory of the Mytishchi urban district. Disposal of that type of waste is quite problematic. Along with that, major way of wood waste disposal today is their use for heat energy generation. During recent years, wood wastes use for energy purposes is considered as an alternative to the traditional fuels.

Mytishchi Teploset JSC developed the project aimed at installation of the Heat and Power Complex on the prepared site, which will be capable of disposal of up to 100 % of district wood wastes and will use generated heat and electric energy in order to solve the issue of continuous heat supply. The company today has gained vast experience of work with accepted wood wastes, preparation of fuel wood, its transportation and disposal (use) in the boiler houses.

In 2017 Heat and Power Complex based on the solid fuel combustion boiler UTPU-RV for 1.5 MW was constructed and put into operation. This project was implemented as a pilot part of the considered project. Though the Complex does not generate electric power, 100 % of its heat energy is released into thermal collector of the operating gas boiler house for 90 MW.



Environmental projects as a tool for effective energy resources use

Project description

Capacities created by the company are not sufficient for disposal of all wood waste formed in the urban district. Mytishchi Heating Network JSC made the decision about the necessity to continue development of this issue and increase disposal volumes through installation of more heavy-duty boiler-house equipment, i.e. design and construction of the Heat and Power Complex with the possibility of electric power generation. The Complex is represented as a central heating and power plant.

Project peculiarities and advantages

1. **Disposal of 100 %** of wood waste formed in the Mytishchi urban district.
2. **Used fuel wood** will be used as an alternative to gas and any other hydrocarbon fuel for power generation. Along with that, load on the landfill is reduced by 20 000 tons.

Wood waste as a fuel have many advantages:

- they are CO₂-neutral;
- they are attributed to renewable power sources;
- contain almost no sulfur;
- ability to burn wet wastes (up to 55 - 60% of moisture);
- reduction of CO₂ emission;
- low corrosion activity of fume gases;
- low cost is compared to fossil fuel.

During wood wastes burning, gas consumption is reduced and “clean” heat energy is generated, and ash obtained in the result of burning is used by the municipal gardening and landscaping enterprise for fertilizers preparation.

3. **Minimum project implementation period** (up to 10 months). Prepared enterprise facilities (wastes acceptance, fuel preparation, available solid fuel boiler houses)
4. **Release of 100 % generated heat energy** into “process heat ring” (Complex location closely to the “process ring” facilitates year-round 100 % heat release).
5. **Electric power generation** for own needs with the possibility of surplus delivery to the network. (Fuel wood preparation is energy-consuming. Secondary disposer consumes up to 200 kW/h of electric power). Own generation of electric power significantly reduces direct costs of the enterprise for fuel preparation and enables to gain additional profit from sale.

Thank you!