United Nations Development Programme in Kazakhstan (UNDP)

Global Environment Facility (GEF)

The Government of the Republic of Kazakhstan

Empowered lives.
Resilient nations.

Success story

Projects implemented jointly by UNDP, various donors and the Government of Kazakhstan on energy saving in housing and community utilities and construction

The series of publications review the most successful sustainable practices, resulted in ecological, economic and social benefits from the implemented projects in energy efficiency in the residential buildings, municipal heating, construction and in general in housing and community utilities.

Association of Apartment Owners "Maksat": about Energy Efficiency

PROJECT LIFE CYCLE

- SELECTION OF A FACILITY
- SIGNING RECIPROCAL CONTRACT WITH OWNERS
- PROJECT DESIGN AND COST DETERMINATION
- PREPARATION OF GRANT APPLICATION
- GRANT FROM UNDP/GEF
- EQUIPMENT SUPPLY AND INSTALLATION CONTRACT EXECUTION
- SUPPLY, INSTALLATION, PUTTING EQUIPMENT INTO OPERATION
- ENERGY-EFFICIENCY REVOLVING FUND STRUCTURING
- THE IMPLEMENTATION OF ADDITIONAL ENERGY EFFICIENCY MEASURES OF SAVINGS FOR HEAT

Primary Project Outcomes:

3 326 156 KZT

Cost-cutting (transferred to energy-efficiency revolving fund)

09.2011 - 04.2016

Impact estimated for the period

Heat supply quality improved (heating, hot water supply)

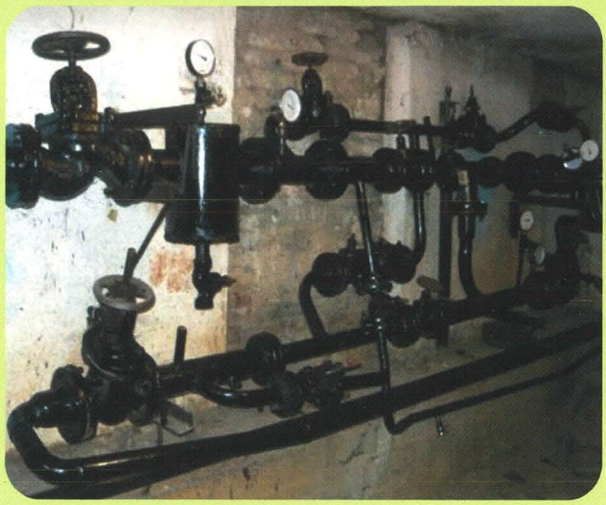
27% (417 Gcal)

Reduction of heat energy consumption

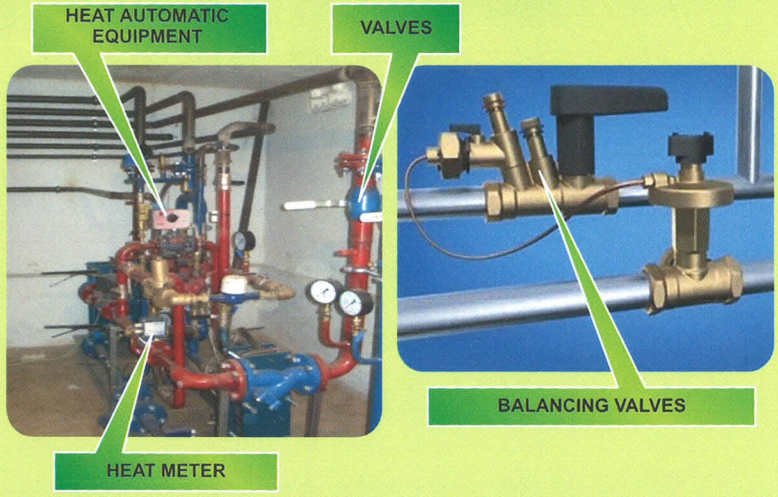
219,4 tons

Greenhouse gas emission reduction

BEFORE RECONSTRUCTION



AFTER RECONSTRUCTION:



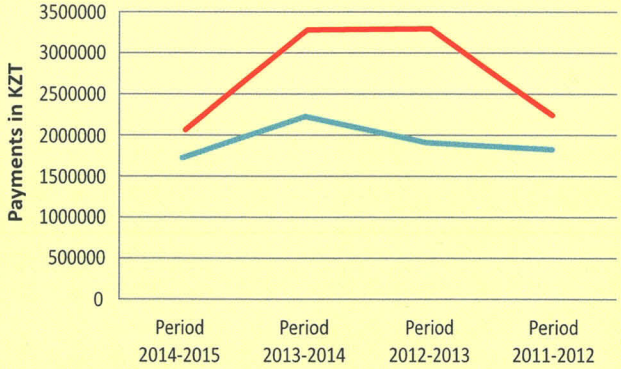
IMPLEMENTED

- Heat meter installed
- Heat automatic equipment installed
- Complete replacement of pipeline and valves within heat supply station
- Installation of balancing valves on heat supply system's downcomer tubes
- Installation of energy saving insulated glazing in the entrances (from energy-efficiency revolving fund)
- Thermal insulation of pipelines of heating systems and of hot water supply within the heat point

ACHIEVED

- Consumption based billing
- Providing comfortable environment in residential areas
- Providing qualitative hot-water supply
- Reduced heat consumption and, consequently, decrease of costs due to consumption based billing
- Improving reliability of heat supply station's equipment, minimization of any casualty-producing capacity
- Steady flow of heat transfer medium in the downcomer tubes provided; and, as a result, even heating penetration in the heating apparatus achieved
- Heat loss reduction through building envelope by a qualitative improvement in heat insulating characteristics of windows
- Heat loss reduction in the heat transfer medium from the conduit surface, increased quality of heat supply

Dynamic patter of the amounts paid for the consumer heat energy



Cost-cutting estimation of the payment for consumed heating energy and for the chemically purified water due to the heat metering installation and rehabilitation of heat supply system

Implementation period	Total paid for the heat energy on the basis of municipal rate (dwellers pay to the cooperative of apartment owners), KZT	Cooperative of apartment owners pays to the heat and hot water supply companies	Cost-cutting in the payment for consumed heat energy, KZT	
			TOTAL	%
Period 2014-2015	2,083,626.6	1,731,261.6	352,365.0	16.9
Period 2013-2014	3,297,780.4	2,226,026.2	1,071,754.2	32.5
Period 2012-2013	3,286,555.6	1,924,217.7	1,362,337.9	41.5
Period 2011-2012	2,255,456.6	1,843,261.4	412,195.2	18.3
TOTAL	10,923,419.2	7,724,766.9	3,198,652.3	27.3

Background:

#25 school was built in 1962. Prior to the project, the connection of the school to the city heat networks had been implemented through water-jet elevator, **which hadn't provided the control of thermal energy** in the building. Relatively low pressure, developed by the elevator, hadn't allow to ensure the effective operation of the heating system in a deterioration of the inner pipe. **There were underheating and overheating cases.** Also there was no control of the temperature of water for hot water supply in accordance with the sanitary standards. In addition, there was **overheating of the return water temperature** compare to the work schedule of the central heating networks of the city. People were always **complaining about the low temperature in the gym and some areas** of classrooms. **Increased heat losses** due to window openings were identified. Wood-frame double-glazed windows didn't provide modern thermal protection. Considerable **deterioration of wooden** frames were identified in some places. As a result **the windows could not be opened,** which led to the poor classes ventilation. In winter, the stuff and schoolchildren were forced **to stick frames with paper tape** to keep warm in the building.

What has been done?

Glazing of the building:

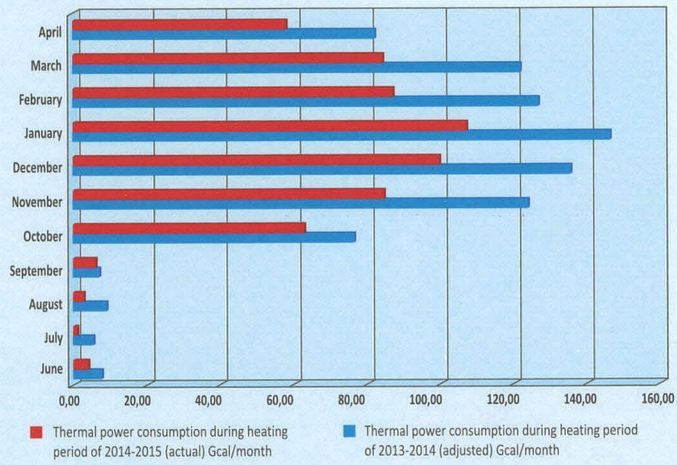
- A modern energy-saving window units with a reduced resistance to heat transfer of more than 0.8 $m^2 \cdot {}^0C / W$ (while required today, as per rule, is no more than 0.6 $m^2 \cdot {}^0C / W$) have been installed.
- Plastic window sills width 450 mm have been installed.
- Galvanized steel weirs have been installed.
- Moisture-resistant drywall of gypsum plasterboard internal slopes are installed (with insulated thermo inlay) have been installed.
- Premises ventilation has been provided by applying a special window fittings.

Heating system:

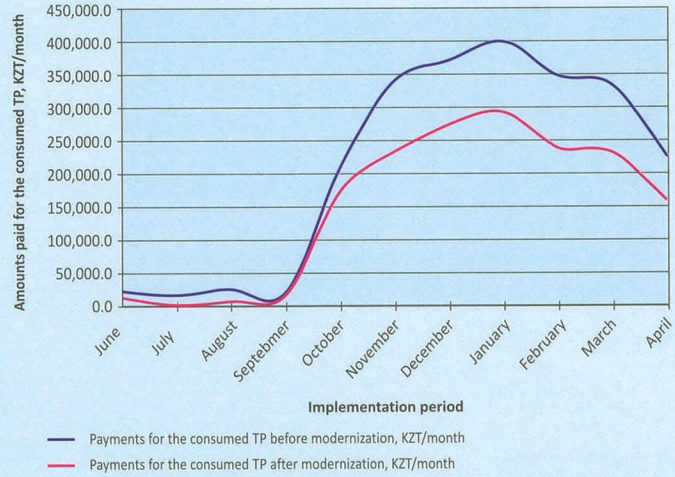
- All elements of the metering unit (flow, temperature transmitters) have been replaced; heat energy metering station has been additionally espied with pressure sensors.
- Differential pressure controller has been installed.
- Collapsible plate heat exchangers for domestic hot water[1] with circulation pump and hot water temperature control have been installed which allow to ensure the maintenance of the temperature of hot water in accordance with the sanitary standards.[2]
- Heating system has been equipped with control valves with mixing pumps.[3]
- To ensure the regulation of heat energy (the so-called "smart heating") an electronic two-channel microprocessor controller has been installed with weather compensated brand ECL310 with electronic key management A2661.[4]
- Automatic balancing valves in every riser heating system have been installed.[5]
- Heating system connecting the registers of smooth pipes on the two-pipe system with simultaneous movement of the coolant in the gym reconstructed, thermostatic valve with presetting[6] installed.

Results:

#25 Secondary School in Astana.
Comparison of the integrated demand of the thermal power on heating and hot water supply between 2013-2014 and 2014-2015



Dynamics of the changes in payment amounts for the consumed thermal power due to the ACPT equipment installation

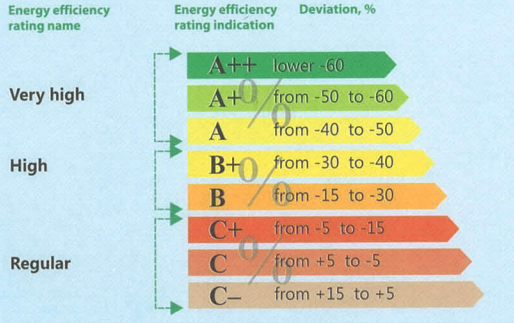


Project results:

#25 Secondary School

Energy efficiency rating of residential and public buildings

During the design and operation of new and reconstructed buildings



During the operation of existing buildings

C+
("standard")

[1] Efficiency of the plate heat exchangers is significantly higher than the efficiency of previously installedshell and tube thermal water heaters.

[2] Applied DHW connection scheme eliminates supply of unused amounts of thermal energy to the needs of domestic hot water in the heating circuit during a hot water minimum consumption hours, as well as at night and on weekends.

[3] Pumps with the converter engine speed are installed, which allow maintaining a given pressure drop at the pump.

[4] Temperature and water flow in heating and hot water is regulated on the basis of signals from the sensors and the coolant temperature of outside air.

[5] Provide uniform flow distribution of coolant in the internal circuit of the heating system of the building.

[6] The system provides uniform heating radiators and normalization temperature in the gym.

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Success stories

of the joint projects of UNDP and the Government of the Republic of Kazakhstan and different sponsors of energy efficiency in housing and construction

This series of articles provide an overview of the most successful sustainable practices. The implementation of the projects in energy efficiency in buildings, heating, construction and housing produced ecological, economic and social benefits.

#25 Secondary School in Astana:

Learning conditions of schoolchildren improvement. Thermal comfort provision and contribution to global environmental protection

This project is aimed at demonstrating an example of improvement of the educational environment for students in a typical office building in Astana, as part of the overall approach to neutralize greenhouse gas emissions (carbon footprint) of the organization (EBRD).

The main goal of this project is to improve the energy efficiency of school buildings, based on the proposed recommendations of energy auditors.

The project resulted in decreased funding from the annual budget for heating and electricity as well as improved heating provision of school facilities.

It also allowed reducing the negative impact on the environment by reducing GHG emissions due to a more rational consumption of heat in the building.

Main results:

668 thousand KZT	1,2 K	68 people	80%	29%	103,8 tons
					
Annual budget savings to pay for thermal energy	*Improved conditions for learning*	*Improved conditions for teachers*	*Annual savings of heat for hot water*	*Annual savings of heat in the building (heating and DHW)*	*Prevented greenhouse gas emissions in one year*

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Karaganda – energy effective integrated reconstruction of residential apartment building:

Demonstration of additional advantages resulted from modernization of the heat consumption system in the building and window replacement

This project aims to demonstrate additional benefits for the owners of apartments gained as a result of the energy-efficient modernization of the heat consumption of the building and replacement of all window constructions.

When carrying out repairs in apartment buildings, including under current program of repairs MOR (in the framework of the state program of modernization of housing and communal services – currently the regional development program), owners of apartments, in taking a decision on repairs, as a rule, refuse to install the so-called "smart heating" (automated thermal point with heat meters (ATP)). Also, under the effective regulations in Kazakhstan windows in residential apartment buildings (except for the windows in entrance halls) are individually owned. The replacement of windows with more energy effective ones in the building is not included in the list of works on repairing common facilities. In these two cases owners fail to fully gain direct benefits from heat saving after the repair is made, since windows account for up to 21% of heat loss in a building. Therefore, "smart heating" can reduce heat consumption by 15-25% along with maintaining proper comfort in the building.

For the major renovation of the building the UNDP/GEF projects allocated additional funds for the installation of ATP with heat meters and the replacement with energy effective window constructions.

The outcome of the project is that owners are allowed to manage their bills for heat consumption – ATP installed with a metering device regulates heat in the building and energy effective windows also save heat. Living conditions in the apartments are significantly improved.

Primary Project Outcomes:

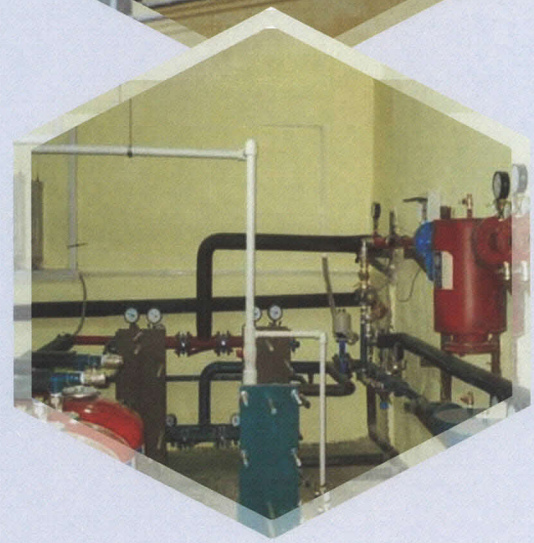
8,17 mln. KZT	308 sq.m	25 apartments	52 Gcal	16%	28 tons
					
Sum of extra investments into energy saving of the building	*Windows replaced*	*Living conditions improved*	*Annual heat saving in the building (heating and hot water supply)*		*Prevented emissions of green house gases*

Characteristics of the building before renovation:

NN	Name of the component	Characteristics
1	Climatic zone	Central Kazakhstan, Karaganda
2	Type of the building	Residential apartment building
3	Year of construction	1959
4	Number of floors	3 (three)
5	Number of apartments	25 (twenty five)
6	Number of entrance halls	4 (four)
7	Material of walls*	Brick walls. Thickness of walls – about 0,68 m (brick laying – 2,5 brick). Coefficient of heat transmission of windows = 0,89 vt/m^2 • ^{0}C
8	Type of windows	PVC windows. Single frame. Double glazing. Coefficient of heat transmission of windows = 1,6 vt/m^2 • ^{0}C
9	Type of roof*	Duo-pitch roof, metal tile roofing. The basis of the ceiling is a concrete slab with thickness of 220 mm and slag with thickness of about 200 mm is used as a heat insulator. Coefficient of heat transmission of the roof = 0,77 vt/m^2 • ^{0}C
10	Floor*	Reinforced concrete slabs over unheated basement Coefficient of heat transmission of floor = 1,81 vt/m^2 • ^{0}C

* - according to SNIP RK 5.03-37-2005. "Bearing and enclosing structures".

View of the building after implementation of the integrated reconstruction project

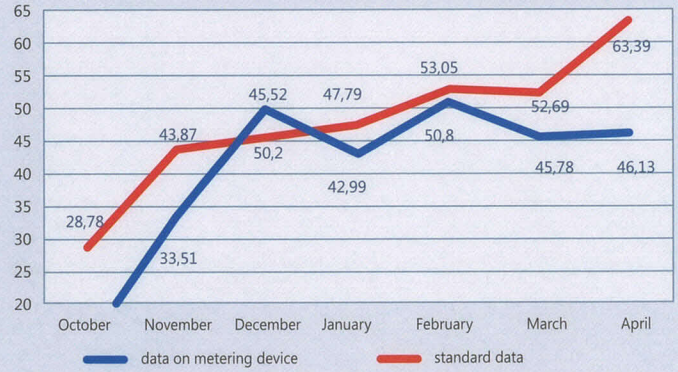


What was done in the site?

- All the windows in the building replaced (from wooden to metal and plastic)
- The automated thermal point with heat meters installed
- Distribution pipelines of the heating system isolated

Replacement of window constructions			
Total area (m^2) Windows of the main building	308,04 (118 items.)	Resistance of windows to heat transmission vt/m^2 • ^{0}C	0,56
Type of material	plastics		
Type of frame/box	double		
Type of glazing	Double glazing		

Thermal power for heating the building by months



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Karaganda – modernization of heat consumption system using ESCO (energy service contract) mechanism: "energy saving" by installment

This project is the first project aimed to demonstrate an example of modernization of apartment building using mechanism of energy service company – ESCO (i.e. energy service contract").

ESCO invests its own assets in modernizations of heating units for energy-saving purposes by concluding energy-performance contract with Cooperatives of Apartment Owners (managing companies) for return of investments in proportion to savings during the project. Within the model KaragandyZhyluSbyt (Distributive company in Karaganda) acts as an operator on receipt of payments for heat energy according to metering devices. All other functions on economy billing, charges and collection of payment for energy services, as well as transition to ESCO, performed by Cooperatives of Apartment Owners.

Outcomes of the Project

2.9 mln. KZT	5,5 mln. KZT	Up to 27%	Up to 140 tons	Up to 762 thousand KZT
				
Cost of energy service contract (ATP with metering unit + service)	*Additional actions on energy efficiency (windows, roof, basement etc..)*	*Annual heat saving by a house*	*Annual reduction of greenhouse emission*	*Savings in payments for heat energy in cold season*

Conditions before Project:

- No heat energy metering device
- Connection of heat water supply system to heating network was performed via open dead-end system (direct water draw-off from supplying central heating system)
- Circulation of water in hot water system is not maintained
- Heating circuit is connected to the heating network via dependent scheme through jet elevator
- Equipment installed in heat energy input unit does not allow adjustment of energy resource delivery for heating and water supply needs
- Inter-panel joints required repair
- Windows in entrance halls required replacement
- Roofs required repair
- Significant heat losses due to cold covering of the first floor

Achievements:

- complete reconstruction of heating unit of the house – automatic heat consumption adjustment system according to the weather and heat transfer agent was installed + PU;
- adjusting and isolation valves were replaced (valves, locking devices in heating units).
- Performance contract was signed (energy service contract)!!!
- Additional actions on energy efficiency in buildings (grant): heat-insulated and repaired roof, heat-insulated basement, replaced windows in entrance halls, heat-insulated entrance doors, repaired joints, installed balanced valves on heating risers, isolated distri-buting pipes.

House modernization fragments

ESCO model advantages (so called "energy efficiency by installment"):

- No need for initial investments from apartment owners in project implementation
- Energy savings due in cost of payments for ESCO services
- Owners obtain renewed estate without initial capital investments
- Modernization payment is made in installments