CONCLUSION ON ENERGY SAVING AND ENERGY EFFICIENCY IMPROVEMENT

CONTENT

FULL NAME	Position	Type of work	Signature	
Puziy V.Yu.	Head of the Energy Audit Department	Project execution control Checking the Energy Saving Report		
Sheginbayeva A.K.	Energy Auditor	Project management preparation and summary of the conclusion on energy		
Altybassarov R.A.	Energy Auditor	Carrying out instrumental analysis and examination of the electrical part		
Raziyev B.	Energy Auditor	Conducting instrumental analysis and examination of the thermal part		
Kassenov O.	Energy Auditor	Processing of instrumental examination data on the thermal part		
Akimzhanov T.	Energy Auditor	Processing of instrumental examination data on the electrical part		

TERMS, DEFINITIONS, DESIGNATIONS AND ABBREVIATIONS

Terms and definitions

The following terms and definitions are used in this report.

State Energy Register – a systematic set of information about the subjects of the State Energy Register.

Energy efficiency class of an electric energy – consuming device is the level of energy efficiency of an electric energy-consuming device, characterizing its energy efficiency at the operational stage.

Energy conservation and energy efficiency improvement management (energy management) – a set of administrative actions aimed at ensuring rational consumption of energy resources and improving the energy efficiency of a management facility, including the development and implementation of energy conservation and energy efficiency policies, action plans, procedures and methods for monitoring, assessing energy consumption and other actions aimed at improving energy efficiency.

subjects of the State Energy Register – individual entrepreneurs and legal entities that consume energy resources in an amount equivalent to one thousand five hundred and more tons of conventional fuel per year, as well as government agencies, quasi-public sector entities and natural monopolies that consume energy resources in an amount equivalent to one hundred and more tons of conventional fuel per year

thermomodernization – an event to improve thermal engineering characteristics of buildings, structures, and structures, leading to a reduction in thermal energy losses in them

conventional fuel – a unit adopted in technical and economic calculations, regulated in regulations and standards, which serves to compare the thermal value of various types of organic fuels

energy resources – a set of natural and produced energy carriers whose stored energy is currently being used or may be used in the future in economic and other types of activities, as well as types of energy (atomic, electrical, chemical, electromagnetic, thermal and other types of energy)

energy audit (energy audit) – collection, processing and analysis of data on the use of energy resources in order to assess the possibility and potential of energy conservation and prepare an opinion

energy auditing organization – a legal entity that performs energy audits

energy conservation – the implementation of organizational, technical, technological, economic and other measures aimed at reducing the volume of energy resources used

efficient use of energy resources – the achievement of a technically feasible and economically justified level of use of energy resources.

Designations

The following designations are used in this report.

Gcal – a gigacalory (a unit of measurement of the amount of thermal energy);

kWh – kilowatt-hour (unit of measurement of the amount of active electrical energy) kg.u.t. - kilogram of conventional fuel

TEF – ton of conventional fuel

Abbreviations

The following abbreviations are used in this report.

GPS – Global Positioning System
ISO – International Organization for Standardization)
LED – LED
ATP – automatic thermal point
GCE – gas cylinder equipment
DWS – hot water supply
Fuel and lubricants – fuels and lubricants
GDO – gas distribution organization
AML – Arc mercury lamp
DF – diesel fuel
FLS – fuel level sensor
IBR – individual boiler room
CFL – compact fluorescent lamp
Administrative Code of the Republic of Kazakhstan – Code of the Republic of Kazakhstan "On Administrative Offenses"
HWP – heating and winter period
SS – substation
PUE – Rules for electrical installations
PB – Production branches
SN RK – building regulations of the Republic of Kazakhstan
DHS – district heating system
EMS – Energy Management System
TFL – tubular fluorescent lamp
VT – voltage transformer
CT – current transformer
Feasibility study – feasibility study
Fuel and energy complex – fuel and energy resource
XX – idle speed
CGCP – cabinet gas control point

INTRODUCTION

In accordance with the requirements of the Law of the Republic of Kazakhstan dated January 13, 2012 No. 541-IV "On Energy Conservation and Energy Efficiency Improvement" (hereinafter referred to as the Law), an energy audit was conducted in accordance with the "Rules for Energy Audit" approved by the Order of the Minister of Investment and Development of the Republic of Kazakhstan dated March 31, 2015 No. 400 (hereinafter referred to as the Rules). facilities of JSC Kazakhtelecom .

The energy audit of JSC Kazakhtelecom is conducted for the first time. At the same time, the branches of JSC Kazakhtelecom conducted an energy audit.

For the reporting year 2023, the consumption of energy resources of JSC Kazakhtelecom amounted to 49,620.6 tons. Based on this volume of fuel and energy complex consumption, JSC Kazakhtelecom was included in the State Energy Register of the Republic of Kazakhstan. As a subject of the SER, JSC Kazakhtelecom is obliged to provide information on energy conservation to the Operator of the SER, conduct an energy audit and implement an action plan for energy

conservation and energy efficiency improvement developed based on the results of the energy audit.

According to the conducted energy audit, the estimated energy saving potential of JSC Kazakhtelecom is **0.8%,** or 403.85 TEF.

The draft Action Plan for Energy Conservation and Energy Efficiency Improvement of JSC Kazakhtelecom for 2026-2030 includes both economically feasible measures (the present value of which is positive in the fifth year of the project, and the internal rate of return exceeds the discount rate used by two percent or more) and measures with a long payback period, but ensuring reliability and process stability. The energy efficiency indicators of JSC Kazakhtelecom for the future have been determined, taking into account the implementation of energy saving measures until 2030.

The energy efficiency class has been calculated for 167 heated buildings of JSC Kazakhtelecom branches with a heated area of more than 50 m2.

The energy audit of JSC Kazakhtelecom included facilities located in the following branches:

- Almaty Service Factory and the region;
- Kostanay Service Factory and the region;
- North Kazakhstan Service Factory and region;
- South Kazakhstan Service Factory;
- West Kazakhstan Service Factory;
- Central Kazakhstan and the region Service factory (Astana, Akmola region, Karaganda region);
- Semey Service Factory;
- Oskemen Service Factory;
- Service Factory in Pavlodar and the region;

I INTRODUCTORY PART

1. INFORMATION ON THE CONCLUDED CONTRACT AND THE ENERGY AUDIT FACILITY

Service purchase **agreement**

Customer:

JSC Kazakhtelecom

Chairman of the Management Board K. B. Yessekeev

Astana, Sauran str., 12

+7 (717) 2543-236

Energy audit organization:

"Energy on Track" LLP

Director Sh.Z. Suleimenova

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Energy on Track LLP has been a member of the Register of Legal Entities Operating in the

field of Energy Conservation and Energy Efficiency Improvement since March 04, 2019, No. 137.

JSC Kazakhtelecom – the largest telecommunications company in Kazakhstan and has the status of a national telecommunications operator.

The Company owns the National Information Superhighway, which is a fiber-optic transport ring connecting large cities of Kazakhstan with high-speed digital data transmission.

A Kazakhstani telecommunications company with the status of a national company. It is the largest fixed telephony operator in Kazakhstan, as well as one of the largest operators of the national data transmission network. It provides broadband Internet access, digital television, cellular communications, local and international telephone services, etc.

The company's two main offices are located in the cities of Astana and Almaty. It has branches in all regions of Kazakhstan.

JSC Kazakhtelecom 's divisions are represented by the company's regional and urban telecommunications networks located in 237 localities, of which:

- 17 cities of national significance,
- 24 small towns,
- 159 district centers,
- 54 settlements with a designated area code (former district centers).

The main production activity of the regional divisions of JSC Kazakhtelecom is the construction, operation, repair and maintenance of telecommunications networks and auxiliary technological equipment designed to provide continuous and trouble-free access to Internet resources and telecommunications systems.

The main offices are located in Astana and Almaty, and regional branches are located in 17 regions of the Republic of Kazakhstan.

Branches of JSC Kazakhtelecom :

- Business-to-Business Division (hereinafter – the BBD);
- Business-to-Customer Division (hereinafter – the BCD);
- "Network" Division Association (hereinafter – the SLM);
- Information Technologies Division (hereinafter – the ITD);
- Project Management Directorate (hereinafter – the PMD);
- Telecom Supply Directorate (hereinafter – the TSD);
- Service Factory (hereinafter – the SF);
- "Academy of infocommunication technologies" Directorate (hereinafter – the Corporate University).

Based on the provided data of the SF branch of JSC Kazakhtelecom on the balance sheet of branches located in the regions of the Republic of Kazakhstan from them:

- 526 facilities (65%) are connected to the centralized heating system;
- 40 facilities (5%) have an autonomous solid fuel heating source;
- 107 facilities (13.2%) have an autonomous heating source with liquid fuel;
- 108 facilities (13.4%) have an autonomous gas-fired heating source;
- an autonomous electric heating point for 28 facilities (3.5%).

The Service Factory provides:

- trouble-free and uninterrupted operation of heat supply systems, hot and cold water supply, utility networks, administrative areas;
- organization and control of the work of technical personnel to maintain the office premises and the territory of JSC Kazakhtelecom in proper sanitary and aesthetic condition;
- ensuring the implementation of the provisions of the Environmental Policy in the field of environmental protection for economic activities;
- development and coordination of issues related to the implementation of a comprehensive outsourcing program.

JSC Kazakhtelecom is actively developing an energy management policy and taking measures to improve energy efficiency. In 2023, the company developed and approved an "Energy Management Policy" and analyzed the Energy Registry of production facilities that consume energy resources. The documented procedure "Identification of types of energy. Definition of bases. Energy Analysis", which provides for internal procedures for monitoring the quantitative and qualitative indicators of the energy registry equipment.

2. CHARACTERISTICS OF POWER SUPPLY SYSTEMS

2.1 POWER SUPPLY SYSTEM

The Service Factory is engaged in the operation and maintenance of the power supply system at the branches of JSC Kazakhtelecom .

JSC Kazakhtelecom , being a major consumer of electricity throughout Kazakhstan, buys it from various energy supply organizations. Electricity supply contracts have been signed with all these organizations. The list of energy supply organizations of JSC Kazakhtelecom branches is given in Table 1.1.

Table 1.1

No.	JSC Kazakhtelecom Branch	Electricity supply company	Contract
1	Aktobe Service Factory	AktobeEnergoSnab LLP SNPS-Aktobemunaigas JSC	No. 22855/6/04-DP-01 dated 05.01.2024 No. 7-04-DU-01 -Aktobe DESD dated 05.01.2024
2	Uralsk Service Factory	Batysenergoresurs LLP	No.05335/105/04-DP-01-DESD dated 29.01.2024
3	Atyrau Service Factory	AtyrauEnergosatu LLP	
4	Mangystau Service Factory	Mangystau Zharyk LLP	No. 0712-AUES-22 dated 01.01.2024
6	Kostanay Service Factory	Kostanay Energy Center LLP	No.17623/30-05-29- DZ dated 01/24/2023
		MSE "Kostanayuzhelectroservice"	No. 57/12-04-DE dated 01/23/2024
		MSE "Zhitikarakommunzergo"	No.18/10-04-DE dated 01/23/2024
		MSE Lisakovskgorkommunenergo	No. 43-11-04-DE dated 01/23/2024
		Rudnenskaya Energy Company LLP	No.910/09-04-DE dated 01/23/2024
7	Kokshetau Service Factory	Kokshetauenergotsentr LLP	No.1100035-05-29-DE dated 04.01.2023
	Service Factory of Astana and the region	LLP "Astanaenergosbyt"	No. 9604 dated 12/20/2022
		LLP "AREK-Energosbyt" Akkol branch	410 dated 01.01.2023
		AREK-Energosbyt LLP Arshalinsky branch	303 dated 01.01.2023
		AREK-Energosbyt LLP Atbasar branch	315 dated 01.01.2023
		AREK-Energosbyt LLP Astrakhan branch	316 dated 01.01.2023
		AREK-Energosbyt LLP Atbasar branch	46 from 01.01.2023
		AREK-Energosbyt LLP Bulandinsky branch	54 from 01.01.2023
		AREK-Energosbyt LLP Yerementau branch	184 dated 01.01.2023

		AREK-Energosbyt LLP, Yesil branch	128 dated 01.01.2023
		AREK-Energosbyt LLP Zhaksyn branch	3 dated 01.01.2023
		AREK-Energosbyt LLP Zharkain branch	30 dated 01.01.2023
		AREK-Energosbyt LLP, Shortandinsky branch	44 dated 01.01.2023
		LLP "Astanaenergosbyt"	0086 dated 01.01.2023
		LLP "Kokshetauenergotsentr" Kenesary	140002860 dated 01.01.2023
		LLP "Kokshetauenergotsentr" Shchuchinsk	130005874 dated 01.01.2023
	"Network" Division Association Semey	LLP "Shygysenergotrade"	008105 dated 05.01.2023 010086 dated 04.01.2023 028012 dated 04.01.2023 050077 dated 04.01.2023 063062 dated 04.01.2023 063102 dated 04.01.2023 063120 dated 04.01.2023 090097 dated 04.01.2023 142223 dated 04.01.2023 200122 dated 04.01.2023 230018 dated 04.01.2023
	Service Factory of Karaganda and the region	LLP "Elektrzhabdyktau"	№72 dated 19.12.2022
		LLP "Balkhashenergo-1"	№3 dated 26.12.2022
		LLP "Settlement service Center"	№03-11 dated January 1, 2023.
		LLP "Karaganda zhylu sales"	No. E3023/23 dated January 1, 2023.
		LLP "Kazenergocenter"	No. 25230002 dated December 17, 2022.
	Service Factory - Taraz	LLP "Zhambylzharyk sauda 2030"	No. 903A dated 03.01.2023
	Service Factory - Kyzylorda		
	Service Factory - Almaty and the regions	Almatyenergosbyt	No. 52365 dated 05.01.2022 No. 10945 dated 05.01.2022 No. 48748 dated 05.01.2022 No. 24327 dated 05.01.2022 . No. 31139 dated 05.01.2022 No. 70137 dated 05.01.2022 No. 902629 dated 05.01.2022 .
		Zhetysuenergotrade JSC	No. 3106 dated 11.01.2024 No. 151175 dated 18.01.2024 No. 211083 dated 03.01.2024 No. 201279 dated 17.01.2024 No. 14007249 dated 22.01.2024 No. 12226 dated 11.01.2024 Contract No. 232451 dated 12.01.2024

			№19009015 dated 18.01.2024г.
	Service Factory - Shymkent	LLP "Energotok"	№1913-05 dated
		SH Algabas	№82/4-1-6/ДУ/ЦЭиК dated 13.02.2023
8		Shieli Zharygy LLP	№51/4-1-6/ДУ/ЦЭиК dated 27.01.2023
		Shymkent Kus LLP	16/4-1-6/ДУ/ЦЭиК dated 18.01.2023
		IP Sagindykov	121/4-1-6/ДУ/ЦЭиК dated 27.03.2023
9		Kazteleradio JSC	№152/4-1-6/ДУ/ЦЭиК dated 31.03.2023
		SPB of KazTransGas Aimak JSC	№15/4-1-6/ДУ/ЦЭиК dated 18.01.2023
		MSE Turkestan Higher Agricultural College	№48/4-1-6/ДУ/ЦЭиК dated 27.01.2023
10		Nur-Arystan LLP	№17/4-1-6/ДУ/ЦЭиК dated 18.01.2023
		Bereke Corporation LLP	№46/4-1-6/ДУ/ЦЭиК dated 27.01.2023
		IP Seisenova	№45/4-1-6/ДУ/ЦЭиК dated 27.01.2023
		IP Zhunusov	№49/4-1-6/ДУ/ЦЭиК dated 27.01.2023
		Factory Module LLP	№50/4-1-6/ДУ/ЦЭиК dated 27.01.2023
		Agrofirma Shymkent Tukym LLP	№44/4-1-6/ДУ/ЦЭиК dated 23.01.2023
		Avtovokzal SAMAL LLP	№47/4-1-6/ДУ/ЦЭиК dated 27.01.2023
		KCELL JSC	№252/4-1 -6/ДУ/ЦЭиК dated 05.07.2023

In the absence of power supply from the main power sources, the buildings of the production branches of JSC Kazakhtelecom use diesel generator sets (DGS) as backup power sources to ensure uninterrupted operation of telecommunications equipment, especially in remote and hard-to-reach areas of Kazakhstan, shown in Figure 1.1-1.4, Table 1.2

Fig. 1.1

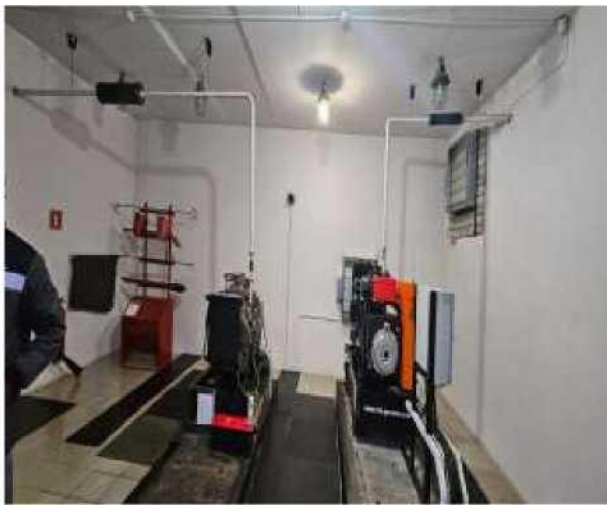

Fig. 1.2

Fig. 1.3

Fig. 1.4

Table 1.2

No.	Name	Name of the branch	Quantity, pcs.	Power, kVA
1	1E15LMA3ST	Aktobe SF	3	15
2	1E10 MA3	Shymkent SF	1	10
3	1E100MA3	Aktobe SF	1	1000
		Kostanay region SF (Arkalyk)	1	
4	1E18 MA3	Turkestan region SF	1	18
5	1E18MA2	Turkestan region SF	2	18
6	1E18MA3	W-Kazakhstan region SF	4	18
7	1E200MA3	Aktobe region SF	3	200
8	1E30CA3	Kostanay region SF	12	30
		Pavlodar region SF	1	30
9	1E800MtMA3	Kostanay region SF	1	640

10	1E8HLM	Kostanay region SF	2	8
11	1EA-2B	Kostanay region SF	7	2
12	1E 48 MA3	Karaganda region SF	2	48
		Pavlodar region SF	1	48
13	1E100MA3	Akmola region	2	100
14	1E10ДMA	Turkestan region SF	1	18
15	1E10MA3	Aktobe region SF	1	10
16	1E150MA3	Turkestan region SF	1	150
17	1E18MA3	Aktobe region SF	1	30
18		Turkestan region SF	1	30
19	1E150MA3	Turkestan region SF	1	150
20	1EA-4LMA	Kostanay region SF	1	4
21	48 M1	Aktobe region SF	1	48
22	5KJT25ATSB	Kostanay region SF	1	20
23	APD 33	Turkestan region SF	4	24
2	"APD-33A «AKSA» "	Shymkent SF	1	24
25	C44D5	Kostanay region SF	3	35
26	DAEWO	Turkestan region, SF	1	30
27	"Daewoo PJJ 94/75 (OC 130017110335)"	Astana	1	75
28	DS 5500A ES	Kostanay region SF	1	5
29	DY3000LX	Kostanay region SF	15	2
30	E10DMA	Kostanay region SF	1	10
31	E10HLMA	Akmola region SF	5	8
32	E130DMST	Kostanay region SF	1	104
33	E30DMA	Kostanay region SF	1	30
		Aktobe region SF	1	18
		W-Kazakhstan region SF	1	24
34	EDIGI,21.9UVA RiD 650 B-SERiES	Shymkent SF	1	500
35	EA-4	Kostanay region SF	5	4
36	EA-5LM(E)	Kostanay region SF	2	5
37	FG Wilson (P30P1)	Karaganda region SF	1	30
38	FPG 9800E+ATE	Aktobe region SF	1	7,5
39	FPG4500	Kostanay region SF	2	3
40	GEKO 5401 E-AA/ZHD	Kostanay region SF	3	5
41	GF3 50KW	Turkestan region SF	4	50

42	HIMOINSA HHW-150T5	Pavlodar region SF	1	120
43	Himoinsa HSW-455 T5	Aktobe SF	2	364
44	KDE 12 STA	Kostanay region SF	2	8,5
45	KDE 12STA3	Shymkent SF	1	10
46	KDE 16 STA3	Kostanay region SF	1	13,5
47	KDE 6500E	Kostanay region SF	30	4
48	KDE 6500E3	Kostanay region SF	5	4
49	KDE 6500X3	Kostanay region SF	2	4
50	KDE6500E	Kostanay region SF	3	4
51	KJT20	Kostanay region SF	7	13
52	P 12,5 P2	W-Kazakhstan region SF	2	10
53	P GB-12	Turkestan region SF	1	30
54	PJB	Pavlodar region SF	1	44
		Turkestan region SF	4	50
55	PJB - 12	Turkestan region SF	2	50
56	PJB 12 (30 кВт)	Kostanay region SF	3	30
57	PJB 12 (55кВт)	Turkestan region SF	1	55
58	PJJ 12	Kostanay region SF	1	75
59	PJK DAEWOO	Pavlodar region SF	1	92
60	RID 100 C-SERIES	Aktobe SF	1	100
61	RID 15 E-SERIES	Aktobe region SF	1	15
62	RID 30 E-SERIES S	Kostanay region SF	1	24
63	RID 40 S-SERIES/RID1000A	Aktobe region SF	1	30
64	RIO 15 E	Turkestan region SF	2	32
65	SDG 7000EHA	Kostanay region SF	30	6,5
66	SDG6000EHA	Kostanay region SF	12	6,0
67	SH-30GF	Turkestan region SF	1	24
68	TD15000STE	Kostanay region SF	1	10
69	TEKSAN	Turkestan region SF	2	24
70	TG-3900R	Kostanay region SF	12	2,5
71	TG-7200R	Kostanay region SF	18	5,0
72	TG-9600EATS	Kostanay region SF	3	6,0
73	TJ46PE5A	Aktobe region SF	2	30
74	TSS SDG 6000EHA	Kostanay region SF	1	6
75	"WILSON 169 KVA (OC 130017112518)"	Karaganda region SF	1	144
76	YKS-8500E	Kostanay region SF	1	6,5

77	YKS-Q8500E	Kostanay region SF	2	6,5
78	AD100S T400 2R	Aktobe region SF	1	100
79	Astra 275	Kostanay region SF	1	200
80	DGA E130 DM A.	Pavlodar region SF	1	100
81	DGA E200 MAZ	Pavlodar region SF	1	200
82	DGA 1E 100 MAZ	Pavlodar region SF	2	100
83	DGA 1E 200 MAZ	Pavlodar region SF	1	100
84	DGA 1E 48 MAZ	Karaganda region SF	1	48
85	ДГА 600кВт-С/380/III УВН	Pavlodar region SF	1	660
86	ДГА FG Wilson F50-1 CAL 49,8кВА/39,8/кВт	Pavlodar region SF	1	39,8
87	ДГА RID40 E-SERIES	Pavlodar region SF	1	32
88	ДГА YKS-DN35	Pavlodar region SF	1	35
89	ДГА E3ODMA	Turkestan region SF	2	30
90	ДГА200кВт DAEWOO	Pavlodar region SF	1	254
91	ДГА-3-48м1	Karaganda region SF	1	48
92	ДГА-48М	Kostanay region SF	1	48
93	Diesel Generator 1E18MA3	Karaganda region SF	1	16
94	Diesel Generator 1E10MA3	Karaganda region SF	10	10
95	Diesel Generator 1E18MA3	Karaganda region SF	8	18
96	Diesel Generator 1E24MA3	Karaganda region SF	2	24
97	Diesel Generator 1E30SA3	Karaganda region SF	2	30
98	Diesel Generator 1E4MA3	Karaganda region SF	2	4
99	Diesel generator 1 E18MA3	Karaganda region SF	1	18
100	Diesel generator 1 E4MA3	Almaty region SF	1	4

The number and manufacturers of electricity metering devices by production branches of JSC Kazakhtelecom are shown in Table 1.3. No information was provided to the electricity metering system for the branches missing in this table.

Table 1.3

No.	**Name of the branch**	**Quantity, pcs.**	**Manufacturer of electricity metering devices**
1	Astana	1	Saiman
2	Almaty PB	1	Mercury 230
3	Kostanay region SF	57	Saiman
		71	Energy meters
		54	MZEP
		27	Mercury
		13	Milur IS

		5	Typit-IP
		36	NNPO FRUNZE
		4	IS Meganorm
		15	CJSC Technologist
4	Aktobe region SF	3	Elster Metronics
		8	Mercury
		3	Teletec
		11	NNPO FRUNZE
		64	Saiman
		1	Energy
		101	Saiman
5	Pavlodar region SF	2	Saiman
		4	Matrix
		14	Mercury
		1	NNPO FRUNZE
		10	Energy
6	Karaganda region SF	1	ELSTER
		38	Mercury
		33	Saiman
7	Akmola region SF	81	Saiman
		327	Mercury
		8	NIK
		10	Matrix
		24	Energy
8	Taraz SF	9	Energy
		1	Techno Complex CJSC
		3	Saiman

Lighting system

Based on the data provided by JSC Kazakhtelecom , the main share in the lighting system is occupied by LED lamps - 5,257 units, incandescent lamps - 202 units, fluorescent lamps - 3,301 units, information on the lighting system was not provided for many branches, and therefore data is missing.

Fig. 1.5

Fig. 1.6

Fig. 1.7

Fig. 1.8

Fig. 1.9

Fig. 1.10

Рис. 1.12

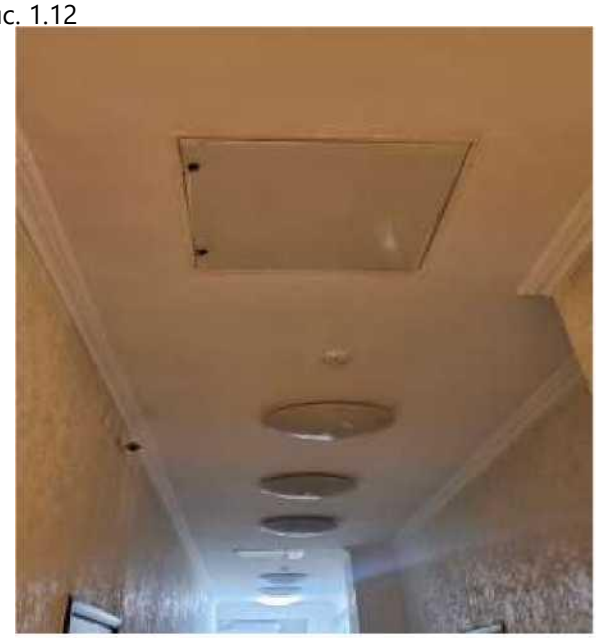

Fig. 1.11

Fig. 1.12

Fig. 1.13

Fig. 1.14

Ventilation system

Air ventilation at JSC Kazakhtelecom facilities is mostly provided by natural air circulation. Supply and exhaust units are installed in the buildings of JSC Kazakhtelecom 's Data Centres. This is because the main purpose of Data Centres is to create the necessary conditions for servers: optimal humidity, the required temperature and uninterrupted high-speed internet. The main purpose of ventilation in a Data Centre is to remove excess heat generated by servers and equipment.

In a supply ventilation system, air exchange occurs due to the pressure difference created by the fan. This method of ventilation is more efficient, as the air can be pre-cleaned of dust and brought to the required temperature and humidity. Such systems can supply and remove air from local areas of the room in the required quantity, regardless of changing environmental conditions. If necessary, the air is subjected to various types of treatment (cleaning, heating, humidification, etc.), which is practically impossible in natural ventilation systems. To ensure ventilation, the building is equipped

with snail-shaped exhaust fans, their automation and starting equipment.

An unorganized natural ventilation system refers to air exchange in a room that occurs due to the difference in pressure between the internal and external air and the action of the wind through gaps in the building envelope, as well as when windows, transoms and doors are opened.

The ventilation system is in satisfactory condition, the ventilation system equipment is in good working order, no comments or defects have been found.

Supply and exhaust units equipped with motors ranging from 0.1 kW to 10 kW. Types shown in Fig. 1.14-1.17, location of ventilation units in Table 1.4.

Table 1.4

No.	**Location of ventilation systems**	**Кол-во, шт**
1	Pavlodar Service Factory	12
2	Mangystau Service Factory	11
3	Taraz Service Factory	4
4	Taraz Service Factory	12
5	Shymkent Service Factory and the region	69
6	TUSM-10, Karaganda, «Network» Division Association	19
7	ITD-branch of JSC Kazakhtelecom, Ust-Kamenogorsk Data Center	2
8	ITD is a branch of JSC Kazakhtelecom, Kokshetau Data Center	2
9	ITD-branch of JSC Kazakhtelecom , Almaty Data Center	1
10	ITD-branch of JSC Kazakhtelecom , Pavlodar Data Center	2
11	ITD-branch of JSC Kazakhtelecom , Petropavlovsk Data Center	1
12	ITD-branch of JSC Kazakhtelecom , Semey Data Center	1
13	ITD-branch of JSC Kazakhtelecom , Shymkent Data Center	1
14	ITD-branch of Kazaztelecom JSC, Kostanay Data Center	2
15	TUSM-6 Semey	12
		333

Fig 1.15

Fig. 1.16

Fig. 1.17

2.2 HEAT SUPPLY SYSTEM

Heat supply to JSC Kazakhtelecom facilities is provided by its own autonomous boiler rooms and central heating systems. The number of buildings and structures owned by JSC Kazakhtelecom and heated by boiler rooms or a centralized heat supply system, with an area exceeding 50 m2, is 167.

Contracts for the provision of heat energy supply services have been concluded for facilities located in regional centres. Heat supply contracts are listed in Table 1.5.

Table 1.5

No.	JSC Kazakhtelecom Branch	Heat supply company	Contract
1	Astana Service Factory and the region	Astanaenergosbyt LLP	No. 4025 dated 12/20/2022/ 7-07-06- 1.2-DU dated 20.12.2022
		MSE na PHV Tselinograd municipal service	No. 73 dated 03.01.2024
2	Almaty Service Factory	Almaty Thermal Networks LLP	No.36830 dated 01.01.2023; No.36987 dated 01.01.2023 No. 36187 dated 01.01.2023.
3	Service Factory of Almaty region	MSE na PHV "Ile su" teplo "Thermal networks" LLP JSC "Kaskelenskoye" MSE on the PCV "Zhylu Ortalygy"	№ 2002/02-0015 dated 05.01.2023 № 215 dated 04.01.2023 122024dated 03.01.2023 №1329 dated 01.12.2022
4	Zhetysu Region Service Factory	KGP on PCV "Taldykorganteploservice "	№51/A-01-55-K dated 31.01.2023г №215 dated 31.01.2023

		Tekeli Energy Complex LLP	№ I/A-OI-55-K dated 03.01.2023
5	Taraz Service Factory	JSC"Tarazenergocenter"	№93/05-06/ДУ dated 07.03.2023
		State Enterprise "Zhambyl Zhylu"	№92/05-06/ДУ dated 06.03.2023
		State Enterprise "Zhanatas Vodokanal"	№107/05-06/ДУ dated 16.03.2023
6	Aktobe Service Factory	Agtobe su-energy group JSC	№131/3-01-56-У-2023 dated 16.02.2023
7	Atyrau Service Factory	Atyrau Thermal Power Plant JSC	№33/3-01-56-У dated 26.01.2023
		MSE at the Aksaizhylykuat Nuclear Power Plant of Akim of Burlinsky district	№24/3-01-56-У-2023 dated 19.01.2023
		JSC"KazTransGas Aimak	№101-3-01-55-У-2022 dated 24.02.2022
	Uralsk Service Factory	JSCZhaiykteploenergo"	№25/3-01-56-У-2023 dated 20.01.2023г.
8	Mangystau Service Factory	LLP "MAEK-Kazatomprom"	№121/3-01-56-У-2023 dated 16.02.2023
9	Kyzylorda Service Factory	ZHI MKK"Kyzlordateploelectric power Plant"	№036 dated 16.02.2023г.
10	Shymkent Service Factory	Kuatzhuluortalyk-3	№20718 dated 04.01.2023
11	Pavlodar Service Factory	Pavlodarenergosbyt LLP, the city of Pavlodar	№23681 dated 01.01.2024г.
		Ekibastuzteploenergo LLP	№23681 dated 01.07.2021г.
		TNK Kazchrome JSC	№23-799 dated 27.01.2023г.
		MSE Teploservice-Aksu	№29/701 dated 01.01.2024г.
		MSEKometa"	№27 dated 03.01.2024
		MSE"May-Service"	№1 dated 03.01.2024
		MSE"Acco-Service"	№9 dated 05.01.2024
		POF JSC "Kazpost" city of Pavlodar village Shcherbakty	№100006532 dated 01.01.2024
		POF JSC "Kazpost" city of Pavlodar village of Uspenka	№100006533 dated 01.01.2024
		POF JSC "Kazpost" city of Pavlodar village of Aktogay	№100006535 dated 01.01.2024

		POF JSC "Kazpost" the city of Pavlodar, the village of Irtyshsk	Agreement No. 100006534 dated 01.01.2024

According to the agreement, there is no maximum hourly heat load for JSC Kazakhtelecom facilities, and therefore data on calculated energy certificates were selected. The data is presented in Table 1.6.

Table 1.6

No.	Name	Thermal load, Gcal
1	Almaty Service Factory and the region	6419,7
2	Kostanay Service Factory and the region	7553,7
3	Petropavlovsk Service Factory of and the region	4551,8
4	South Region Service Factory	4339,7
5	Western Region Service Factory	5391,7
6	Center Service Factory	12475,2
7	Ust-Kamenogorsk Service Factory	3013,9
8	Pavlodar Service Factory	3855,5
9	Semey Service Factory	360,1
		47961,3

Information on heating points (type, temperature chart, type of coolant, etc.) of JSC Kazakhtelecom facilities is shown in Tables 1.7, examples of heating points are shown in Figures 1.18 - 1.25.

Table 1.7

No.	Name	Type	Temperature chart	Type of coolant
1	Almaty, Medeu district, Divayev st., 39	IHP from the boiler room	95/70	Water
2	Almaty, Kalkaman-2 microdistrict, Isatay St. 59	IHP from the boiler room	95/70	Water
3	Belbulak ATE settlement	IHP from the boiler	95/70	Water
4	Esik, Abay St. 109a (ATE-40 № KH003078)	IHP from the boiler room	95/70	Water
5	ATE-30 "Borolday"	IHP from the boiler	95/70	Water
6	ATE-48 "Karaoi"	IHP from the boiler	95/70	Water
7	ATE-71 "Tuimebayeva"	IHP from the boiler	95/70	Water
8	ATE-50 "Zhetygen"	IHP from the boiler	95/70	Water
9	ATE-4 TP345 Kapshagai	IHP from the boiler room	95/70	Water
10	ATE-71 "Tuimebayeva"	IHP from the boiler	95/70	Water
11	Zharkent Central Data	IHP from the boiler	95/70	Water
12	Kegen village	IHP from the boiler	95/70	Water
13	Zhalanash village	IHP from the boiler	95/70	Water
14	ATE Chunja	IHP from the boiler	95/70	Water
15	Usharal, 76 Konayev st.	IHP from the boiler room	95/70	Water

16	Almaly	IHP from the boiler	95/70	Water
17	Auliekolsky district Auliekolsky district, Baitursynova str., 68	IHP from the boiler room	95/70	Water
18	Kamystinsky district, Lenin str., 35	IHP from the boiler room	95/70	Water
19	Sarykolsky district, Lenin str., 80	IHP from the boiler room	95/70	Water
20	Uzunkolsky district, Uzunkol village, Abylaikhan str., 69	IHP from the boiler room	95/70	Water
21	Auliekolsky district, village Kushmurun, German.Gorky, D. N.121	IHP from the boiler room	95/70	Water
22	Karasu district, Oktyabrskoye, Lenin, named after 18	IHP from the boiler room	95/70	Water
23	Bulaevo, A. Moldagulova str. -7	IHP from the boiler room	95/70	Water
24	Mamluk, Lenin str. 51	IHP from the boiler room	95/70	Water
25	Bulaevo,S.Mukanova str., 14, CLCS-	IHP from the boiler room	95/70	Water
26	88 Karmakshinsky district, Najosaly, Abaya str., No. 45	IHP from the boiler room	95/70	Water
27	Zhalagash, Zheltoksan str., 4	IHP from the boiler room	95/70	Water
28	, Aralsk, ul. Baktybai batyr, b/n	IHP from the boiler room	95/70	Water
29	Taraz, Abaya St. 429	IHP from the boiler	95/70	Water
30	Karatau, Konayev st., 48	IHP from the boiler room	95/70	Water
31	Shu, Baluan Sholak, 1St.	IHP from the boiler room	95/70	Water
32	Baizak district, Sarykemer B.Batyr 106	IHP from the boiler room	95/70	Water
33	Zhambyk district, Asa village, Abay 119	IHP from the boiler room	95/70	Water
34	Zhualy district, B.Momyshuly village, Rysbek batyr 100	IHP from the boiler room	95/70	Water
35	Kordai district, Kordai village, Tole bi 100	IHP from the boiler room	95/70	Water

36	Merkensky district, Merke village, Ismailova str., 228	IHP from the boiler room	95/70	Water
37	Ryskulovsky district, Kulan village, Ismailova str., 11	IHP from the boiler room	95/70	Water
38	Arys Tolebi str., 63	IHP from the boiler	95/70	Water
39	Sholakkorgan village, Aiteke bi 58	IHP from the boiler room	95/70	Water
40	Shayan village, Baydibek Karashuly St., 51	IHP from the boiler room	95/70	Water
41	Asykata village	IHP from the boiler	95/70	Water
42	Shaulder village, T. Sarsenbayeva St., 13	IHP from the boiler room	95/70	Water
43	Saryagash St. Maily Kozha b\n	IHP from the boiler room	95/70	Water
44	S. T. Ryskulova Ryskulova str. 296	IHP from the boiler room	95/70	Water
45	Langer str. 8 Marta b\n	IHP from the boiler room	95/70	Water
46	Zhetysai str. Baibutaeva b\n	IHP from the boiler room	95/70	Water
47	Kentau, Yasavi ave., 100	IHP from the boiler room	95/70	Water
48	Kazgurt village, Kunaev str., 59	IHP from the boiler room	95/70	Water
49	Shardara, Tole bi str	IHP from the boiler room	95/70	Water
50	., Turkestan Kozhanova 5	IHP from the boiler room	95/70	Water
51	S. Aksukent St. Abylai Khan 62	IHP from the boiler room	95/70	Water
52	Kandyagash, Baimukhambetov str., 5A	IHP from the boiler room	95/70	Water
53	Aktobe, Strelkovaya brigada 101, 5	IHP from the boiler room	95/70	Water
54	Aktobe, Zarechny settlement, Tsentralnaya str., 22A (Production base)	IHP from the boiler room	95/70	Water
55	Aktobe, Letnaya str. 26	IHP from the boiler room	95/70	Water
56	Aksai city, Chapayev str. 113 (KZ TSLKS-143)	IHP from the boiler room	95/70	Water

57	F. Shevchenko, Urgenishbai uly str. 1	IHP from the boiler room	95/70	Water
58	Atyrau, Taimanov str.	IHP from the boiler room	95/70	Water
59	Atyrau, Zhumyker settlement	IHP from the boiler room	95/70	Water
60	Atyrau, Kayyrshakhtin. Zhuldyz, 51, 56	IHP from the boiler room	95/70	Water
61	Atyrau st.Taimanov, 1. TSLKS-132 and ATE	IHP from the boiler room	95/70	Water
62	Semey, 1st line street,1 Transport section	IHP from the boiler room	95/70	Water
63	Bayanaul district, Bayanaul village, Auezov street, 21	IHP from the boiler room	95/70	Water
64	Pavlodar, Sibirskaya street, 89	IHP from the boiler room	95/70	Water

Fig. 1.18

Fig.1.19

Fig. 1.20

Fig.1.21

Fig.1.22

Fig. 1.23

Fig.1.24

Fig.1.25

The heating units at the facilities of JSC Kazakhtelecom are generally in satisfactory condition, in some branches the pipelines are in a worn-out condition, require replacement, and there is no thermal insulation of the pipelines. They are equipped with the necessary control and measuring devices and shut-off valves. There are no heat metering devices at facilities with IHP from the Kazakhtelecom boiler house, the amount of fuel consumed by boilers is taken into account using flow meters integrated into gas boilers.

Fig.1.26

Fig. 1.27

Fig.1.28

Fig.1.29

To improve the energy efficiency of the heating system, it is recommended to modernise the heating station by introducing automation of heating units. The current situation indicates satisfactory energy efficiency in the use of thermal energy.

With appropriate design and implementation of measures, it is possible to achieve savings in heat energy consumption.

Aluminium and castiron radiators and pipe registers without control valves are installed as heating radiators in buildings, and electric heating radiators are installed in some facilities electric heating radiators are installed, which also indicates the possibility of modernizing the internal heating system by installing control valves and replacing cast iron radiators with bimetallic ones. These measures will allow for the rational use of thermal energy and increase the heat output of the heating radiators.

Fig. 1.30

Fig. 1.31

Fig. 1.32

Fig. 1.33

Fig. 1.34

Fig. 1.35

2.4 WATER SUPPLY SYSTEM

Drinking water supply for a significant part of the facilities of JSC Kazakhtelecom branches is carried out from a centralized cold water supply system. Water is consumed for its own household needs, there is no water consumption for production needs. The condition of the water supply system of JSC Kazakhtelecom facilities is in satisfactory condition, in some branches the water supply pipelines are in a worn-out condition and require replacement.

Technical accounting of water consumption for the company's own needs is carried out at all facilities of JSC Kazakhtelecom . The number and names of water meters installed at the facilities of the enterprise are shown in the Table.1.8. and in Fig. 1.36-1.41.

Table1.8

No.	Name of PB KTGA	Quantity	Names
1	Taraz and the region Service Factory	6	Itron, УВК-40, Бетар СГВ, Eco Meter / Casela
2	Pavlodar and the region Service	25	МТК-32, TU-4 UNIMAG-20, Дасу, TV-4, ETK-15, Arzamas, TU-4-20
3	Shymkent Service Factory	12	GOLD CARD, BAYLAN, SSS(ABSHERON)
4	Aktobe and the region Service Factory	17	NETKON, СГВ-20 (Бетар), ZENNER, СГВ-15 Бетар, MTW-

			32, ETW-15, ZR-15, BK-X/25, CASCAD, СВК-15/3/2
	West Kazakhstan Region Service Factory	13	СГВ-15 БЕТАР, Нетпун СВК 15, АКВА L110, CHRONOS, Minomess M, Метрон, MinoL, СГВ-15 Бетар
5	Atyrau Service Factory	19	СГВ-20, Эконом СВ 15-110, Бетар СГВ-15, Decast, Cascad, Экомера-22х,
6	Kostanay Service Factory	2	AKVA
7	Petropavlovsk Service Factory	2	Itelma №21
8	Ust-Kamenogorsk Service Factory	none	None
9	Semey Service Factory	none	none
10	Pavlodar Service Factory	none	

Fig. 1.36

Fig. 1.37

Fig. 1.38

Fig. 1.39

Fig 1.40

Fig. 1.41

2.5 BUILDINGS

JSC Kazakhtelecom has more than 350 buildings and structures for various production purposes on its balance sheet. Of these, the number of buildings heated by individual boilers and district heating systems, as well as with an area exceeding more than 50 m2, is 211 units. The buildings are located in various localities throughout the Republic of Kazakhstan. The characteristics of heated buildings are given in Tables 1.9. and in Figures 1.42-1.51.

The types of main buildings and structures on the balance sheet of JSC Kazakhtelecom by branch are presented in Appendix 6.

Table 1.9

No.	settlement	Number of buildings	Number of floors	Total area, m2	Heating system
1	Astana	11	2	22 804,6	Central
2	Kokshetau	3	2	6280,5	Central
3	Ereymentau	1	1	558,8	Central
4	Stepnogorsk	1	2	2397,2	Central
5	Akmol	1	1	529,3	Central
6	Accolade	1	1	458,0	Central
7	Balkashino	1	1	680,3	Central
8	Yesil	1	1	775,6	Central
9	Atbasar	1	3	1745,4	Central
10	Shortandy	1	2	428,6	Central
11	Zhaksy	1	2	940,0	Central
12	Astrakhan	1	3	1138,5	Central
13	Arshaly	1	2	530,4	Central
14	Shchuchinsk	2	2	590,9	Central
15	Almaty	13	1,2,4	43091,1	Central, IR
16	Taldykorgan	3	1	8451,4	Central
17	Esik	1	3	1225,1	individual boilers
18	Borolday	1	1	284,5	individual boilers
19	Karaoi	1	1	300,5	individual boilers
20	Tuymenbayeva	1	2	147,2	individual boilers
21	Zharkent	1	3	1413,6	individual boilers
22	Kegen	1	1	122,8	individual boilers
23	Zhalanash	1	1	129,1	individual boilers
24	Chunja	1	3	822,0	individual boilers
25	Almaly	1	2	582,0	individual boilers
26	Usharal	1	3	869,5	individual boilers
27	Ushtobe	1	1	441,6	individual boilers
28	Aksu	1	2	567,0	individual boilers
29	Kostanay	7	3,2	16 333,7	district heating systems, individual boilers
30	Auliekol	1	3	1 260,4	individual boilers
31	Kamysty	1	3	885,8	individual boilers
32	Karasu	1	3	1277,8	individual boilers
33	Zatobolsk	1	3	1005,5	individual boilers

34	Borovskoe village	1	3	996,8	individual
35	Sarykol	2	3	1174,7	individual
36	Fedorovka	1	3	1010,7	individual
37	Zhitikara	1	3	2338,5	individual
38	Lisakovsk	1	2	2329,9	individual
39	Kushmurun	1	1	243,0	individual
40	October	1	3	1430,1	individual
41	Arkalyk	1	3	2459,1	district heating systems,
42	Amangeldy	1	1	379,6	district heating systems
43	Rudny	1	2	2505,9	individual
44	Petropavlovsk	6	4	14982,9	Central
45	Bulayev	2	1,2	931,5	Electric, ASO
46	Tayinsha	1	1	321,1	Central
47	S. Smirnovo	1	2	470,6	Central
48	Yavlenka	1	3	1549,8	Central
49	S. Presnovka	1	3	1391,6	Central
50	S. Timiryazevo	1	1	457,0	Central
51	Kishkenekol	1	2	582,1	Central
52	Beskol	1	2	412,5	Central
53	Zhosaly	1	2	403,5	individual
54	Zhalagash	1	2	507,5	individual
55	Taraz	5	2	7745,4	Central
56	Zhanatas	1	2	717,6	Central
57	Karatau	1	2	719,6	individual
58	Shu	1	3	992,6	individual
59	Shymkent	7	3	14804,4	Central
60	Arys	1	1	828,6	individual
61	Shayan	1	2	637,0	individual
62	Sholakkorgan	1	2	386,8	individual
63	Asykata	1	2	584,5	individual
64	Lenger	1	2	745,6	individual
65	Zhetysai	1	2	394,5	individual
66	Kentau	1	2	1581,2	individual
67	Turkestan	1	2	706,2	individual
68	T. Ryskulov	1	2	791,2	individual
69	Aktobe	4	4	14311,6	Central
70	Kandyagash	1	2	590,3	individual
71	Uralsk	5	3	7033,8	Central
72	Aksai	3	2	1259,3	Central
73	Aktau	2	1	357,4	Central
74	F- Shevchenko	1	1	146,0	individual
75	Atyrau	6	2	8982,1	Central, individual boilers
76	Karaganda	5	4	22554,0	Central
77	Temirtau	1	3	1367,0	Central
78	Balkhash	1	4	4749,8	Central
79	Semey	4	3	8112,0	Central
80	Ust-Kamenogorsk	5	3	18069,9	Central

81	Shemonaiha	1	3	1559,0	Central
82	Ayagoz	1	1	275,9	Central
83	Pavlodar	8	3	19012,6	Central
84	Ekibastuz	1	3	2445,8	Central
85	Aktogay	1	2	690,0	Central
86	Bayanauyl	1	2	565,4	individual boilers

The main part of the buildings of JSC Kazakhtelecom , mostly the buildings of regional gas farms, were built in the 70s and 80s of the twentieth century. Most of the buildings, in particular those located in the regional centers of the regions, require major or ongoing repairs.

Fig. 1.43

Fig. 1.42

Fig. 1.44

Fig. 1.45

Fig. 1.46

Fig. 1.47

Fig. 1.48

Fig. 1.49

Fig. 1.50

Fig. 1.51

II MAIN PART

1. ANALYSIS AND STRUCTURE OF ENERGY CONSUMPTION

The consumption of fuel and energy resources by JSC Kazakhtelecom as a whole for the base year 2023, in natural and conventional fuels is shown in Table 2.1.

Table 2.1.

№	Type of energy resource	Consumption of fuel and energy complex of JSC			
		Indicator	UNIT of measurement	Indicator	UNIT of measurement
1	Thermal energy	128 858	Gcal	18 427	TEF
2	Electrical energy	172 172	ths. kWh	21177	TEF
3	Natural Gas	1556550,8	**m3**	1820,5	TEF
4	Gasoline	5350076	л	5350	TEF
5	Diesel fuel	1471491	тыс.л	1471	TEF
6	Stone coal	831	t	520	TEF
7	Liquefied gas	543,9048	t	854	TEF
TOTAL:				49 621	TEF

Consumption of fuel and energy resources by branches of JSC Kazakhtelecom for the base year 2023, in natural and conventional fuels is shown in Tables 2.2-2.10.

Table 2.2

№	Type of energy resource	Consumption of SF of Mangystau region			
		Indicator	UNIT of measurement	Indicator	UNIT of measurement
1	Thermal energy	1902,5	Gcal	271,9	TEF
2	Electrical energy	3561,2	ths. kWh	438,0	TEF
3	Gas	63,0	**m3**	0,073	TEF
4					
TOTAL:				709,9	TEF

Table2.3.

№	Type of energy resource	Consumption of SF of Almaty and the region			
		Indicator	UNIT of measurement	Indicator	UNIT of measurement
1	Thermal energy	908,157	Gcal	129,8	TEF
2	Electrical energy	24 099, 4	ths. kWh	2964,1	TEF
3	Gas	-	**m3**	-	TEF
4	Coal	21,0	t	13,1	TEF
TOTAL:				3107,0	TEF

Table2.4.

№	Type of energy resource	Consumption of SF Pavlodar and the region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	7596,4	Gcal	1086,2	TEF
2	Electrical energy	11 935,4	ths. kWh	1468,0	TEF
3	Coal	52,98	t	32,5	TEF
			TOTAL:	2586,7	TEF

Table2.5.

№	Type of energy resource	Consumption of SF of Zhambyl region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	1461,4	Gcal	208,9	TEF
2	Electrical energy	6768,9	ths. kWh	832,5	TEF
3	Gas	96512	**m3**	112,3	TEF
			TOTAL:	1153,7	TEF

Table2.6.

№	Type of energy resource	Consumption of SF in the West Kazakhstan region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	1808,4	Gcal	258,5	TEF
2	Electrical energy	-	ths. kWh		TEF
3	Gasoline	168 622	л	168,6	TEF
4	Diesel fuel	34629	л	34,6	TEF
5	Liquefied gas	0,809	t	1,4	TEF
			TOTAL:	463,1	TEF

Table2.7.

№	Type of energy resource	Consumption of SF of Kostanay region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	-	Gcal		TEF
2	Electrical energy	8361,8	ths. kWh	1028,4	TEF
3	Gas	-	**m3**		TEF
			TOTAL:	1028,4	TEF

Table2.8.

№	Type of energy resource	Consumption of SF of Kyzylorda and the region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	999,6	Gcal	142,8	TEF
2	Electrical energy	189,2	ths. kWh	23,2	TEF
3	Gas	87,0	**m3**	0,1	TEF
			TOTAL:	166,1	TEF

Table2.9.

№	Type of energy resource	Consumption of SF Southern region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	1199,4	Gcal	171,5	TEF
2	Electrical energy	9780,0	ths. kWh	1202,9	TEF
3	Gas	114,9	**m3**	0,134	TEF
			TOTAL:	1374,5	TEF

Table2.10.

№	Type of energy resource	Consumption of SF of the North Kazakhstan region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	-	Gcal	-	TEF
2	Electrical energy	5486,6	ths. kWh	674,7	TEF
3	Gas	-	**m3**	-	TEF
			TOTAL:	674,7	TEF

Table2.11

№	Type of energy resource	Consumption of SF in the East Kazakhstan region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	-	Gcal	-	TEF
2	Electrical energy	13033	ths. kWh	1603	TEF
3	Gas	-	**m3**	-	TEF
			TOTAL:	1603	TEF

Table2.12

№	Type of energy resource	Consumption of SF of Akmola region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	399,0	Gcal	57,0	TEF
2	Electrical energy	4720,9	ths. kWh	580,6	TEF

3	Gas	-	**m3**	-	TEF
			TOTAL:	637,6	TEF

Table2.13

№	Type of energy resource	Consumption of SF of Aktobe region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	2470,1	Gcal	353,2	TEF
2	Electrical energy	7617,5	ths. kWh	936,9	TEF
3	Gas	395,9	**m3**	1,56	TEF
			TOTAL:	1291,7	TEF

Table2.14

№	Type of energy resource	Consumption of SF of Atyrau region			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	966,5	Gcal	138,1	TEF
2	Electrical energy	-	ths. kWh	-	TEF
3	Gas	1081	**m3**	1,17	TEF
			TOTAL:	139,3	TEF

Table2.15

№	Type of energy resource	Consumption of SF in Astana			
		Indicator	Unit of meas.	Indicator	Unit of meas.
1	Thermal energy	539,5	Gcal	77,0	TEF
2	Electrical energy	13847,7	ths. kWh	1703,2	TEF
3	Gas	-	**m3**	-	TEF
			TOTAL:	1780,2	TEF

The total consumption of fuel and energy resources in conventional fuel is determined on the basis of the "Methodology for providing subjects of the State Energy Register with information necessary for the formation and maintenance of the State Energy Register" as the sum of consumption of all types of energy resources and is recalculated according to conversion coefficients into tons of conventional fuel (TEF):

(thermal energy, Gcal * 0.143) + (electric energy, thousand kWh * 0,123) +

+ (gasoline, l * 0.001103) + (diesel, l * 0.001261) + (gas, m3 * 0.00117) + (coal, t.*0.626)+ (liquefied gas (propane, butane),t *1,57)

The total consumption of fuel and energy resources of JSC KAZAKHTELECOM in 2023 amounted to 49,620.7 tons.

The structure of consumption of TEF of JSC Kazakhtelecom (%) for 2023 is shown in Fig. 2.1.

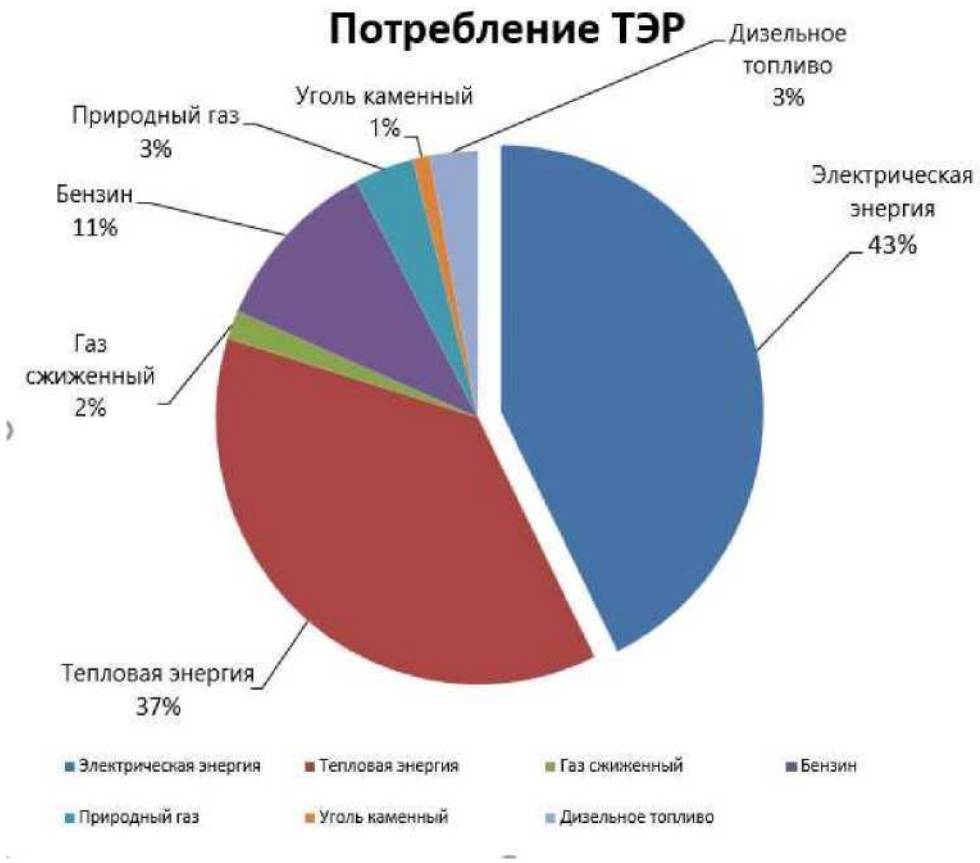

Fig. 2.1

In terms of tons of conventional fuel, the main consumption is electric energy (43%). Liquefied gas (2%) and coal (1%) are consumed in a smaller volume.

Cost structure for consumed fuel and energy resources (%) in 2023 is shown in Figure 2.2.

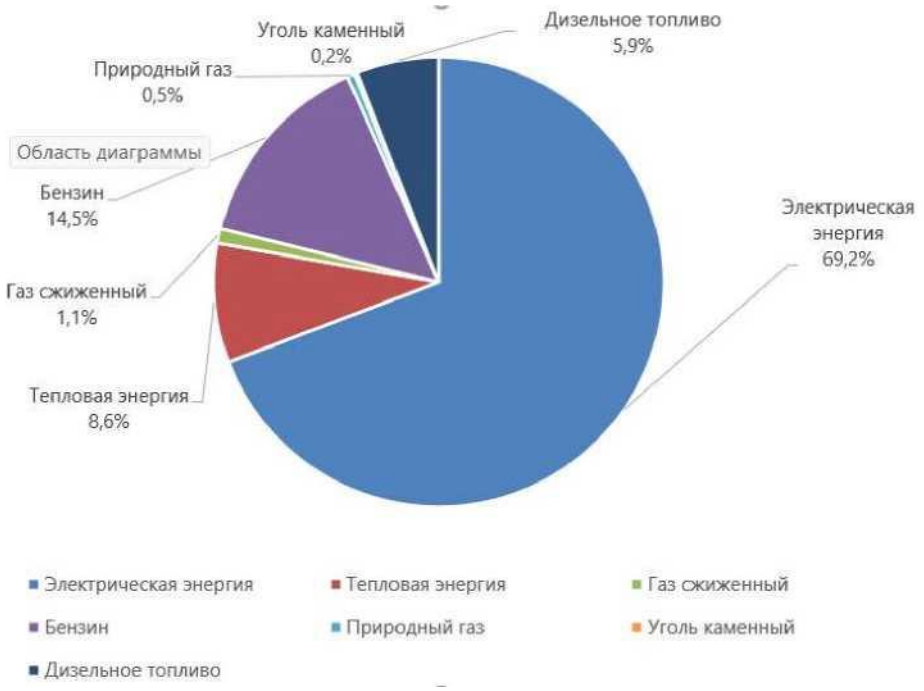

Рис. 2.2

According to the cost structure for consumed energy resources, the costs of electric energy (69.2%), gasoline (14.5%), and thermal energy (8.6%) are significantly higher. Therefore, this Type of energy resource is a priority for analysis and has the greatest potential for energy saving.

Electrical energy

The dynamics of electricity consumption and costs for 2019-2023 by branches of JSC Kazakhtelecom , shown in Tables 2.11 and Figures 2.3-2.4, indicates a slight decrease in the volume of electricity consumption in the branches.

No analyses of electricity consumption were performed in the West Kazakhstan and Atyrau regions, as representatives of these branches did not fully provide the initial data.

Due to the fact that JSC Kazakhtelecom buys electricity from different sources of electricity supply, the average tariff was chosen for calculations.

Table 2.16

Electricity consumption by branches	unit of measurement	2019	2020	2021	2022	2023
Aktobe SF	kWh	8 843 650	8 625 535	8 582 656	7 784 595	7 617 483
Almaty SF	kWh	26 603 708	26 841 782	26 972 650	26 251 246	24 099 386
Atyrau SF	kWh	none	none	none	none	none
Zhambyl SF	kWh	6 465 000	6 791 045	7 517 315	6 946 623	6 768 944
Kyzylorda SF	kWh	196 114	189 012	206 045	206 505	189 261

West Kazakhstan SF	kWh	н/д	н/д	н/д	н/д	н/д
Kostanay SF	kWh	8 360 712	8 614 331	8 509 784	8 429 410	8 350 909
Kyzylorda SF	kWh	196 114	189 012	206 045	206 505	189 261
Mangystau SF	kWh	3 019 688	3 872 095	3 580 349	3 561 201	3 019 688
Turkestan SF	kWh	9 578 963	9 347 896	9 687 459	9 491 911	9 780 038
Karagandy SF	kWh	2 360 664	2 489 644	2 503 195	2 462 044	2 574 792
Pavlodar SF	kWh	4 134 636	4 111 441	3 976 626	3 986 963	3 953 572
North Kazakhstan Region SF	kWh	4 858 719	4 472 555	4 545 965	4 393 731	4 390 323
East Kazakhstan Region SF	kWh	14 232 013	14 042 547	12 772 426	12 593 106	13 032 906
Akmola SF	kWh	7 685 218	7 409 625	7422 128	7 363 021	7 266 997
Astana SF	kWh	14 549 464	13 316 300	13 286 412	13 740 363	13 847 740

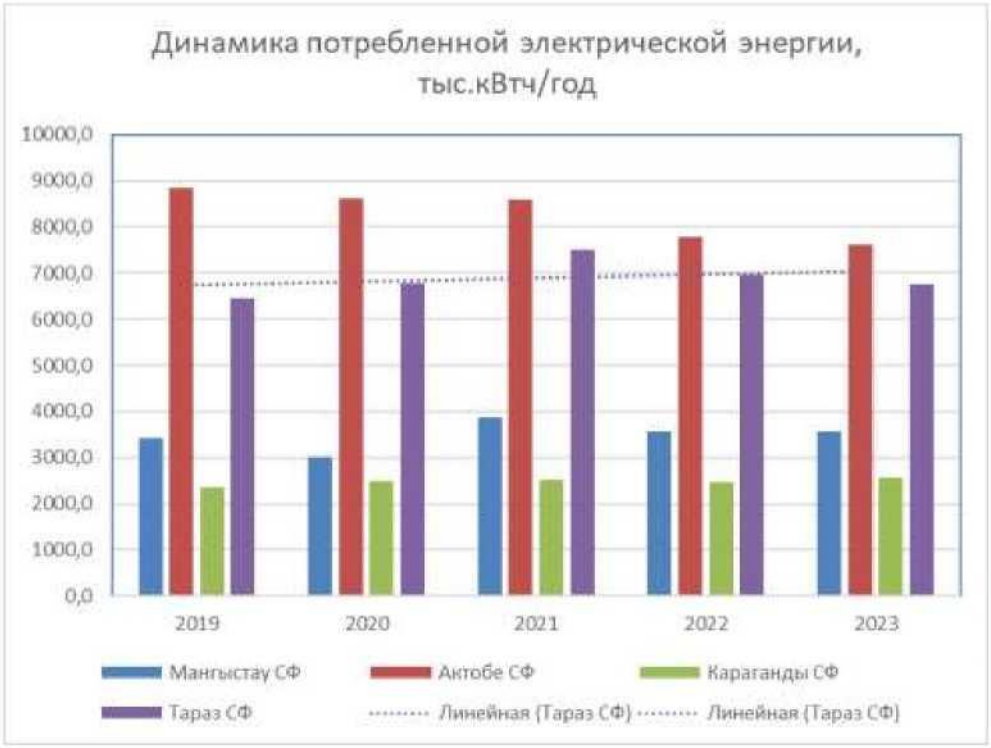

Fig. 2.3

Fig. 2.4

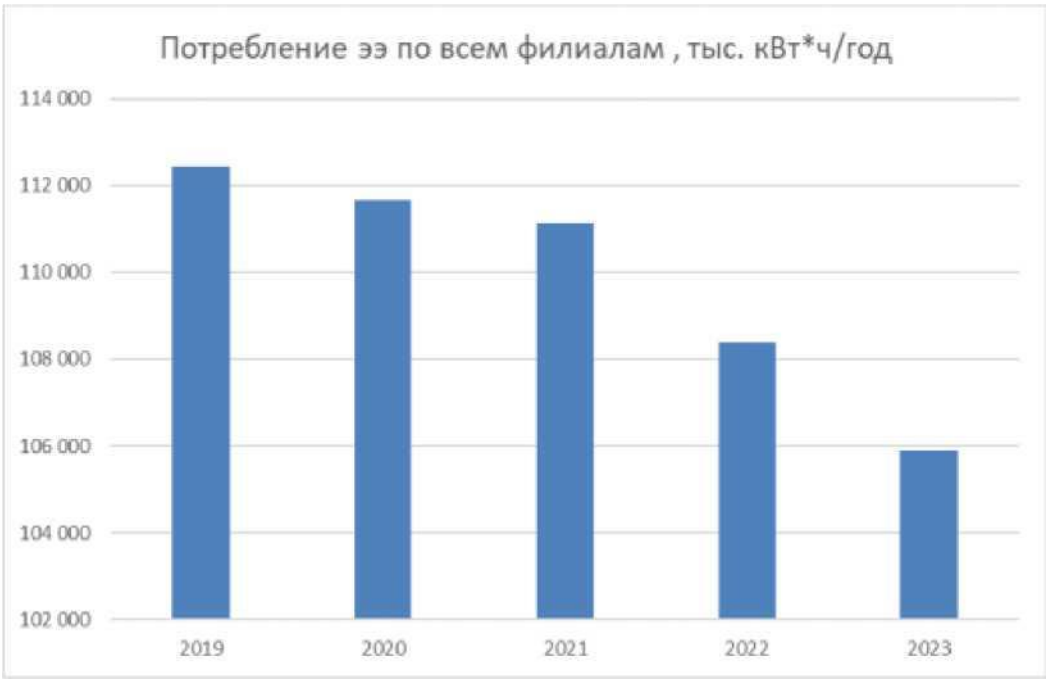

Fig. 2.5

In general, in the context from 2019 to 2023 (Fig.2.5) there is a decrease in electric energy consumption due to the introduction of energy-saving measures in some branches of JSC Kazakhtelecom . There is a great potential for energy savings in all branches of JSC Kazakhtelecom due to the modernization of the lighting system.

Thermal energy

Thermal energy is consumed for the needs of heat supply and hot water supply of JSC Kazakhtelecom facilities. The facilities of SF Astana, SF Akmola region, SF Almaty, SF Pavlodar, SF Karaganda, SF Petropavlovsk, Atyrau SF, West Kazakhstan SF and Kostanay SF are connected to district heating systems. The remaining facilities in the district centers of JSC Kazakhtelecom are provided with heat individually from their own boiler houses, which consume natural gas, diesel fuel, and electricity as fuel.

The dynamics of heat energy consumption in 2023 for facilities that are connected to the DHS, shown in Table 2.11 and Figure 2.6, has a stable consumption pattern, with slight fluctuations during periods of cold weather. The monthly change in heat consumption depends on the duration of the heating season, as well as the average outdoor temperature during the heating period of the year. It follows that with a decrease in the average monthly value of the outdoor air temperature, the consumption of thermal energy increases and, accordingly, with an increase in the average monthly value of the outdoor air temperature, the amount of thermal energy consumed decreases..

Table 2.17

Branch	**Unit of meas.**	**Jan.**	**Feb.**	**March**	**Apr.**	**March**	**June**	**July**	**Aug**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Atyrau SF	Gcal	224,9	203,0	157,1	41,4	1,98	1,9	1,7	1,76	1,7	25,7	125,1	180,4
WK SF	Gcal	506,5	518,0	341,4	150, 4	3,6	0	0	0	0	267,3	362,3	443,4
Almaty SF	Gcal	764,2	878,9	4 450,5	801, 4	217, 0	392, 1	386, 4	249,5	556,9	1 456,4	2 679,5	10 240,6
Mangystau SF	Gcal	752,4	340,4	170,4	59,2	0,0	0,0	0,0	0,0	0,0	71,3	232,4	276,4
Kyzylorda SF	Gcal	197,3	208,2	191,1	65,8	0,0	0,0	0,0	0,0	0,0	27,7	142,1	167,4
Shymkent SF	Gcal	377,1	284,1	159,4	0,0	0,0	0,0	0,0	0,0	0,0	0,3	174,4	204,1
Pavlodar SF	Gcal	1440,6	1354,5	1094,8	631, 6	88,5	16,9	15,2	0,3	1,7	458,2	974,9	1519,2
Taraz SF	Gcal	680,3	219,6	92,3	0,0	0,0	0,0	0,0	0,0	91,6	188,4	189,2	1461,4
Akmola region SF	Gcal	57,5	53,8	56,8	56,8	0,0	0,0	0,0	0,0	5,5	56,8		114,5
Astana SF	Gcal	100,2	95,3	83,4	40,7	0,0	0,0	0,0	0,0		28,8	57,9	66,2

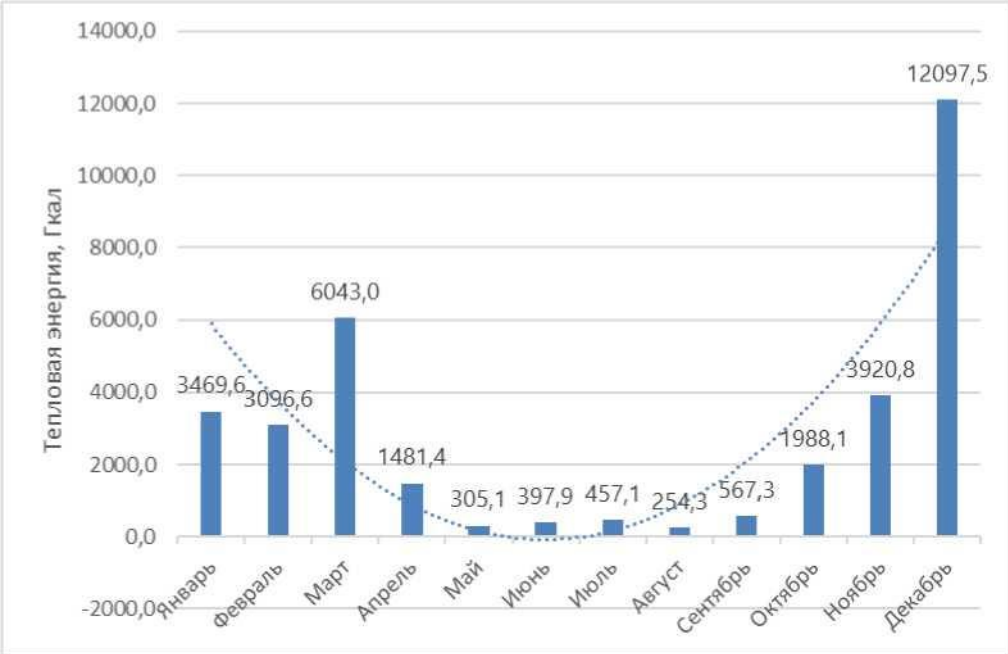

Fig. 2.6

Gas

The calculation of natural gas consumption by branches and facilities of JSC Kazakhtelecom takes into account the consumption of natural gas for its own needs (heating). No gas consumption analyses have been performed for the branches of JSC Kazakhtelecom , as representatives of these branches have not fully provided the initial data.

Water

The facilities of JSC Kazakhtelecom consume Water from a centralized water supply system for the household needs of administrative buildings, as well as for irrigation of green spaces. The dynamics of water consumption in 2023 is shown in Table 2.18 and Figure 2.7.

Table 2.18

Branch	Unit of meas.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Consumption	m3	50,6	69,4	51,3	50,8	50,0	46,2	37,9	50,6	43,7	48,5	50,4	50,5

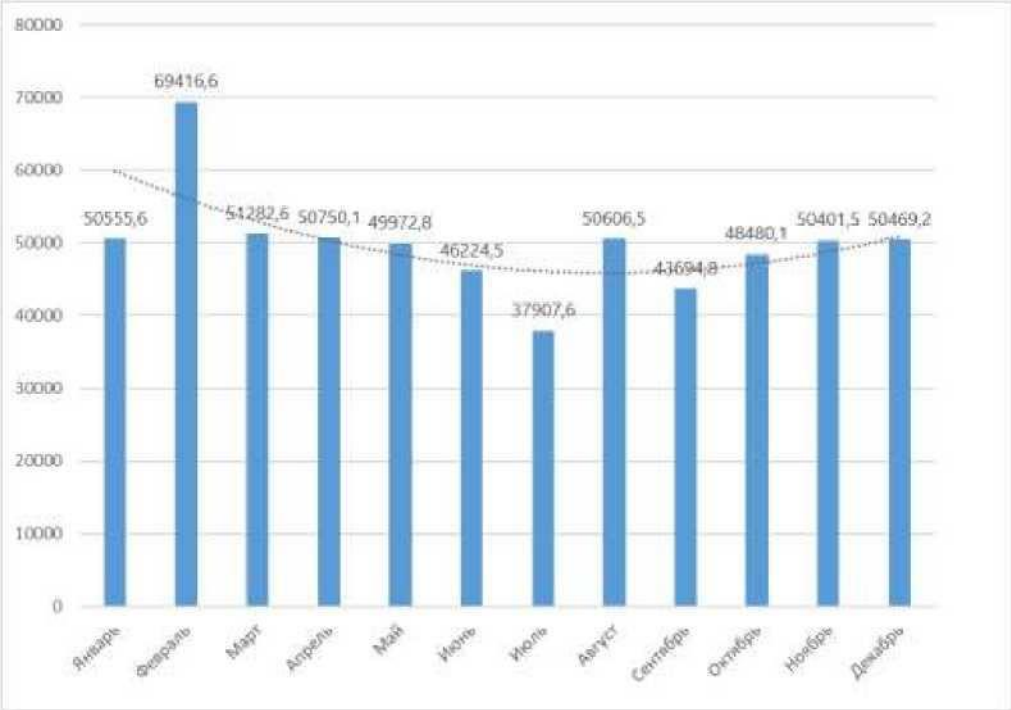

Fig. 2.7

2. CALCULATION OF ACTUAL ENERGY EFFICIENCY INDICATORS OF BUILDINGS

The calculation of the actual energy efficiency indicators of buildings, the specific thermal characteristic qT, is performed in order to assess the energy efficiency class of buildings.

The specific thermal characteristic q_T, W/(m^3 . ° C), is a thermal engineering assessment of the building part of the building, showing the heat flow necessary to increase the temperature of 1 m3 of the volume of the building by 1 ° C.

The actual specific thermal characteristic of the building is calculated using the formula

$$q^{actual} = x = \frac{1163 \cdot 10^3 \cdot Q^{actual} \cdot year}{24 \cdot z^{actual}\ year \cdot \left(t^{actual\ int} - t^{actual\ ext}\right) \cdot v}$$

where Q^{actual}_{year} - thermal energy consumption for building heating in the base year, Gcal/year;

z^{actual}_{year} - the actual duration of the heating period, day.;

t^{actual}_{nt} - the actual average temperature of the indoor air during the heating period, *°C;*

t^{actual}_{ext} - the average outdoor temperature of the coldest five days of the heating season, t^{act}_{ext}=-36°C;

V - building volume, m3.

The actual total specific annual consumption of thermal energy for heating and ventilation is determined in accordance with the Tax Code of the Republic of Kazakhstan. 2.04-04-2011 "thermal protection of buildings" [56] and is calculated using the formulas:

$$D_d = (t_{int} - t_{ht}) \cdot z_{ht},$$

where D_d - degree-day of the heating period;

t_{int} - estimated average indoor air temperature of the building, °C;

t_{ht} - average outdoor temperature during the heated period, °C,

z_{ht} - duration, day, of the heating period.

$$\sum q = \frac{1163 \cdot \sum Q \cdot 10^3}{\mathrm{S} \cdot \mathrm{Dd}}$$

where S - heated area, m2;

$\sum Q$ - total consumption of thermal energy for heating and ventilation, Gcal.

The results of calculations of the actual specific thermal characteristics of buildings are given in Table 2.19.

Table 2.19

№	Building name	Estimated actual specific thermal characteristics of a building, structure, or structure for the base year 2023 (W/m3·°C)
1	Almaty, Ermak str. 17 TUSM-1	D
2	Almaty, Tchaikovsky str., 39-39A/113	D
3	Almaty, Furmanova str., 240-A, B	C-
4	Almaty, Medeu district, Divaev str., 39	D
5	Almaty, Kurmangazy, 112	D
6	Almaty, Brusilovsky str. 70	D
7	Almaty, Zharokova str. 189	D
8	Almaty, 12mkr., 19a	D
9	Almaty, Kalkaman-2 mkr., Isatay59	D
10	Almaty, R.Sorge 17a	D
11	Almaty, Dunentayeva 6b	D
12	Almaty, Beisebayeva 47	D
13	Almaty, Kommunarov 70 "a"	D
14	Taldykorgan, 9 site 20	D
15	Almaty region, Taldykorgan, Mr. "Zhetysu" 10	C
16	CLCS-15	D
17	Taldykorgan, 133 Belova	E
18	Esik, 109a Abay St. (ATE-40 No. KH003078)	D
19	ATE-30"Borolday"	E
20	ATE-48 "Karaoi"	D
21	ATE-71 "Tuimebayeva"	D

22	Kegen	D
23	Zhalanash	D
24	ATE Chunja	D
25	Usharal, Konayev St., 76	D
26	Almaly	E
27	Ushtobe, Akyn Sary St., No. 0.	D
28	Taldykorgan, Yerkin Baza	E
29	Aksu	D
30	Kostanay, Tarana str., 56 (Tauelsizdik,56)	D
31	Kostanay, Al-Farabi ave., 71	C-
32	Auliekolsky district, Auliekolsky station, Baytursinova str., 68	D
33	Kamystinsky district, Kamysty station, Lenin str., 35	D
34	Karabalyksky district, Karabalyk settlement, Kosmonavtov str., 6	D
35	Karasu district, Karasu settlement, Isakov str., 78	D
36	Kostanay district, Zatobolsk settlement, Kalinina str., 63	D
37	Mendykarinsky district, Borovskoye station, Zhenis str., J.8	D
38	Sarykolsky district,Sarykol, Lenin St., 80	D
39	Fedorovsky district, villageFedorovka, Melekhova str., 52	D
40	Kostanay region, Sarykol district, Sarykol square, Tauelsizdik str., 2, Central Park-83	C-
41	Zhitikara, Lenin str., 57	C-
42	Lisakovsk, Mira str., J.39	D
43	Kostanay, Chernyshevsky str., 111	D
44	Kostanay, Panfilov St., D. N.2	D
45	Kostanay, Altynsarina St., 105	C-
46	Kostanay, Karbysheva St., D. N.11	D
47	Kostanay, md.9, 2.14/1	C-

48	Auliekolsky district, Kushmurun settlement, Gorky St., 121	D
49	Karasu district, Oktyabrskoye village, Lenin St., 18	D
50	Amangeldy district, village of Amangeldy, Duisenbina str., 46	D
51	Rudny, village of Kachar, mkrn. 3	E
52	Arkalyk, Abaya ave., 74	D
53	Petropavlovsk, Buketova str., 36	C-
54	Petropavlovsk, Mira str., 282-a	C-
55	Petropavlovsk, Astana str., 35	D
56	Petropavlovsk, Musrepova str., 44	D
57	Bulaevo, A. Moldagulova str., 7	D
58	Tayynsha, Sovetskaya -125a	D
59	Bulaevo, S.Mukanova str., 14, TSLKS-88	E
60	Petropavlovsk, Truda str., 47	D
61	Petropavlovsk, Brusilovsky str., 1, TSLKS-87	D
62	Akkayynsky district, village of Smirnovo, Narodnaya str. 46	D
63	Akkayinsky district, village of Smirnovo	D
64	Yesilsky district, village of Yavlenka, Lenin St. -9	C-
65	Zhambyl district, Presnovka village, Shaikina St. 40	D
66	Timiryazevsky district, Timiryazevo village, Valikhanov St. -5	D
67	Ualikhanov district, village of Kishkenekol,ul. Ualikhanov -81	D
68	Kyzylzhar district, A. Beskol, Gagarin St. -4	D
69	Karmakshinsky districtZhosaly , Abaya St. No. 45	D
70	Zhalagash, Zheltoksan str., 4	D
71	Taraz, Abaya str., 124	D
72	Taraz Turysova str. 5	D
73	Taraz Isataya str. 4b	E
74	Taraz B.Momyshuly str., 34 (ODS)	E
75	Taraz Abaya str., 429	E
76	Zhanatas, Dom Svyazi 3	E
77	Karatau, Konayev str., 48	E
78	Shu, Baluan Sholak str., 1	E
79	Shymkent, Kazybek bi str., 15	D

80	Shymkent Kazybek bi str. 16A	D
81	Shymkent Kazybek bi str. 24	D
82	Shymkent Tynybayev 4	D
83	Shymkent, Yelshibek Batyr St. b/n	D
84	Shymkent, St.Tverskaya b/n (Kurmanbekova, 3)	D
85	Shymkent, 21 mkr., house 57	D
86	Arys Tolebi str. 63	D
87	Sholakkorgan str. Aiteke bi 58	C-
88	Shayan str. Baydibek Karashuly 51	D
89	Asykata	D
90	Ryskulov, Ryskulov 296	D
91	Lenger, 8 Marta b\n	D
92	Zhetysai str. Baibutaeva b\n	D
93	Kentau pr. Yasavi 100	E
94	Turkestan Kozhanova 5	D
95	Aktobe, Aiteke bi str.43	D
96	Aktobe, 41 Abilkayir Khan Ave	D
97	Aktobe, 11 mkr, Az Nauryz str., 36	C-
98	Aktobe, 41A Yeset Batyr str. (TUSM-14)	D
99	Kandyagash, Baymukhambetova str., 5A	D
100	Aktobe, Letnaya str., 26	E
101	Uralsk, Dostyk ave. ,186Uralsk,	D
102	Uralsk, 4 mkr.d.6	D
103	Uralsk, Polevaya str. 3/2	D
104	Aksai Sovetskaya str. 89	E
105	Aksai 4-mkr	D
106	Aksai, 113 Chapaev St. (KZ TSLKS-143)	D
107	Uralsk, Dostyk Avenue, 244	D
108	Uralsk, Tsiolkovsky 4	D
109	Aktau, 29 mkr.	D
110	Aktau, 6 mkr.	D
111	F. Shevchenko, Urgenishbai uly str. 1	D
112	Atyrau, Abaya str 6	D
113	Atyrau, Pushkin St.	D
114	Atyrau, SMP-136 (Datov St.)	D
115	Atyrau, md. Leskhoz	D

116	Atyrau, Taimanova St.	D
117	Atyrau, Zhumyker settlement	D
118	Astana, Sary-Arka district, 26 Abai Ave	C
119	., Astana, Almaty district, Zhirentaeva str.,	C
120	Astana, 31 Abai Ave.,	D
121	Astana, Alash highway 12A,	D
122	Astana, Almaty district, Kenesary str., 55Astana	C
123	, Sary-Arka district, Kutpanova str., 7 (formerly Linnaya str., 7)	C-
124	Astana, Sary-Arka district, Republic Ave., 64	C-
125	Astana, Almaty district, Tselinny district, Zhanibek Tarkhan str., 18Astana	D
126	, Almaty district, Chubary residential area, Atasu str., 19	C-
127	, Astana, Yesil district, Sauran str., 12	C
128	, Kokshetau, Abaya str., 108	C-
129	Kokshetau north industrial zone	C-
130	Kokshetau, 32 Abylai Khan	D
131	St.,Yerementau	C-
132	Arshaly village Tashenova St.,49	D
133	Shchuchinsk, Abylai Khan St., 48	D
134	a.Akmol Gagarin St. 5	D
135	, Akkol Nurmagambetova St., 116	D
136	p.Zhaksy, Lenin St., 10	D
137	Astrakhan village, Al-Farabi St., 49	C

138	Shchuchinsk, Kirov str., 42	D
139	Atbasar, Ch.Valikhanov 3	D
140	Shortandy, Sovetskaya str., 18	D
141	Karaganda, Yermekov str., 31/2	D
142	Karaganda, Yermekov str., 31	C-
143	Karaganda, Stroiteley ave., 4	D
144	Karaganda, md.19 – 57	D
145	Karaganda, Bukhar-Zhyrau ave. 39	D
146	Temirtau, Stroiteley, 34	D
147	Balkhash, Karamende Bi, 13	D
148	Semey, Mamai Batyr str.,72	D
149	Semey, Pozharnaya str.,40a,	D
150	Semey, B.Momyshuly str., 23B	D
151	Semey, 1st line str., Transport section 1	D
152	East Kazakhstan region, Ust-Kamenogorsk, Kazakhstan str., 67;	D
153	East Kazakhstan region Ust-Kamenogorsk ave. Shakarima, 146;	D
154	East Kazakhstan region, Ust-Kamenogorsk ave. Satpayeva, 30/1;	D
155	East Kazakhstan region, Ust-Kamenogorsk, Baybatchina str., 9/1	D
156	Abai region, Ayagoz, Abaya Street 19	D

157	Pavlodar city, Ak. Bekturov, 60	C-
158	Pavlodar, Kataev street, 16	C-
159	Pavlodar, Mashkhur Zhusup street, 325/3	D
160	Pavlodar, Bakinskaya street, 3	D
161	Pavlodar, Vostochnaya Industrial zone,502	D
162	Pavlodar, Bayan Batyr Street, 4	C-
163	Pavlodar, Kataeva street, 95/2	D
164	Pavlodar, Lesnaya street, 1	D
165	Ekibastuz, Mashkhur Zhusup street, 42	D
166	Aktogay district, Aktogay, Kairbayev street, 82	D
167	Bayanaul district, Bayanaul village, Auezov street, 21	D

3. COMPARISON OF THE ACTUAL ENERGY EFFICIENCY INDICATORS OF BUILDINGS WITH THEIR NORMATIVE VALUES AND ANALYSIS OF THE REASONS FOR THE DISCREPANCY

The normalized specific values of heat energy consumption for heating and ventilation of residential and public buildings are established by the "Requirements for Energy efficiency of buildings, structures, structures and their elements that are part of enclosing structures" approved by the Order of the Minister of Investment and Development of the Republic of Kazakhstan dated March 31, 2015 No. 406 and are given in Table 2.20.

Table 2.20

№	Building type	Number of floors of the building							
		1	2	3	4,5	6,7	8,9	10,11	12 and above
1		0,455	0,414	0,372	0,359	0,336	0,319	0,301	0,290

	Residential apartment buildings, hotels, dormitories, boarding schools								
2	Public, except those listed in rows 3-6 of the table	0,487	0,440	0,417	0,371	0,359	0,342	0,324	--
3	Polyclinics and medical institutions, boarding schools	0,394	0,382	0,371	0,359	0,348	0,336	0,324	--
4	Preschool institutions, hospices	0,521	0,521	0,521	--	—	--	—	--
5	After-sales services, cultural and leisure activities, technology parks, warehouses	0,266	0,255	0,243	0,232	0,232	--	—	--
6	Administrative purposes (offices)	0,417	0,394	0,382	0,313	0,278	0,255	0,232	0,232

The energy efficiency of residential and public buildings is determined according to the National Assembly of the Republic of Kazakhstan 2.04-07-2022 Thermal protection of buildings and are given in Table 2.21.

Table2.21

Designation of the energy saving class and its graphic designation		**Name of the energy saving class**	**The deviation of the calculated value of the specific heat consumption for heating the building q_h^{des} from the standard q_h^{req}, %**	**Economic incentives or penalties**
	During the design and operation of new and reconstructed buildings			
A+ + A+ A		Very high	Below - 60 From - 50 to - 60 inclusive From -40 to -50	Economic incentives
B + B		High	From -30 to -40 inclusive	Economic incentives
C + C C -		Normal	From -15 to -30 inclusive	Activities are not bein developed

Designation of the energy saving class and its graphic designation	**Name of the energy saving class**	**The deviation of the calculated value of the specific heat consumption for heating the building q_h^{des} from the standard q_h^{req}, %**	**Economic incentives or penalties**
During the operation of new and renovated buildings			
D	Lowered	From +15.1 to +50 inclusive	Reconstruction with appropriate economic justification
During the operation of existing buildings			
E	Low	More than +50	Reconstruction with an appropriate economic justification, or

In accordance with the Law of the Republic of Kazakhstan 2.04-07-2022 "Thermal protection of buildings" the condition of buildings is extremely low, the average deviation of the calculated from the standard value of the specific consumption of thermal energy for heating is +93%. Most of the buildings have energy efficiency class "D" and "E". The main reason for the low value of specific heat consumption for heating is that a significant part of the buildings and structures that are on the balance sheet of JSC Kazakhtelecom were built during the 80s and 90s of the twentieth century. Accordingly, most of the buildings are mentally and physically worn out and require major repairs with elements of thermal modernization. The level of energy efficiency of buildings is low, it is recommended to carry out measures for thermal protection of buildings and structures.

5. RESULTS OF INSTRUMENTAL MEASUREMENTS

Power supply system.

- Instrumental measurements on the power supply system of JSC Kazakhtelecom facilities are aimed at determining the locations of irrational consumption of electric energy and loss of electric energy in the networks.
- Instrumental measurements on the power supply system:
- - electricity quality analysis;
- - the level of illumination of the interior.

Electricity quality analysis.

Analysis of power consumption parameters based on the results of instrumental measurements. An instrumental examination of the JSC Kazakhtelecom power supply system was carried out by recording daily power consumption parameters using three-phase analyzers of the quality and quantity of electricity C.A 8335 QUALISTAR PLUS and in accordance with the schedule, the measurement scheme using this device is shown in Fig. 2.42.

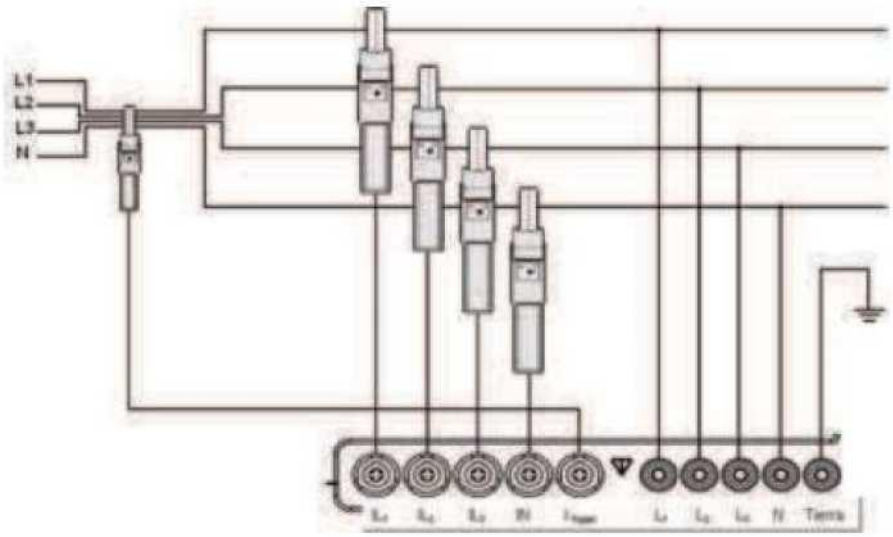

Fig. 2.42

Fig. 2.43

Connection of the electricity quality analyzer in TP RU-0.4 kV in Fig. 2.43.

Fig. 2.44

Connection of the electricity quality analyzer in TP RU-0.4 kV in the Almaty SF in Fig. 2.44.

In the presented case, the current in the L1, L2, L3 phases and the phase voltage between the L1, L2, L3 phases and the neutral are measured. The C.A 8335 QUALISTAR PLUS power quality analyzer collects, analyzes, and processes data. The measured data (first of all, the complex spectrum of current and voltage) is transmitted in real time to a portable (stationary) computer using a USB 2.0 serial port. The attached software allows you to save data in the form of

spreadsheets and use them for further analysis or directly present them in a convenient form using additional software.

Power quality indicators of the C.A 8335 QUALISTAR PLUS device

- Phase voltage deviation <5K±), %;
- Interfacial voltage deviations <5 HZ ±), %
- Frequency deviations ∆/ (±);
- Distortion factor of the voltage sinusoidal curve ;
- The coefficient of the nth harmonic component of the voltage distortion Kc ^y,
- the coefficient of stress asymmetry in the reverse sequence 2 ;
- the coefficient of stress asymmetry in the zero sequence is 0 ;
- Power factor;
- Short-term dose of Pst flicker;
- Long-term dose of Plt flicker;

Thermal imaging examination of electrical panels

A thermal imaging survey of the input cells of the transformer substations of JSC Kazakhtelecom was conducted in October and November 2020, for heating of the contacts. The results of the thermal imaging examination are presented in Appendix No. 1 "Thermal imaging examination".

Conclusions

The results of measurement and analysis of electricity quality indicators, power factor and electricity losses for the remaining facilities of JSC Kazakhtelecom are presented in the form of characteristic graphs and tables in Appendix No. 3 (Protocol of instrumental measurements (electrical part).

Based on the results of the analysis of the parameters of power consumption and the quality of electricity, it can be concluded that the power supply company maintains an appropriate voltage level, namely, the observed values are highly likely to exceed normal and maximum permissible levels. The discrepancy between the registered power coefficients and the regulatory value is explained by the fact that contractual relations between JSC Kazakhtelecom and power supply companies do not establish requirements for compliance with the SOSF, since several electricity consumers are adjacent to the balance sheet distribution sites, the total impact of which most likely meets the requirements of the SOSF standards.

The level of illumination of the interior.

Light level measurements were carried out in the buildings of JSC Kazakhtelecom in the morning and evening from December 2024 to March 2025 with a TKA-LUX luxmeter, according to the Joint Venture of the Republic of Kazakhstan 2.04-104-2012 "Natural and artificial lighting." The results of measurements of the illumination level in the buildings of JSC Kazakhtelecom are given in Appendix No. 2.

Fig. 2.47

Fig. 2.48

Fig. 2.49

III FINAL PART

1. RECOMMENDATIONS

Recommendations on energy conservation and energy efficiency improvement are aimed at optimizing the use of energy resources, organizing and maintaining an efficient mode of consumption of fuel and energy resources (fuel and energy complex) at the facilities of JSC Kazakhtelecom . The recommendations also include low-cost energy-saving measures carried out as part of routine repairs and maintenance, as well as unprofitable energy-saving measures (with a long payback period).

The main recommendations for energy saving:

- perform the replacement of sealing rubber bands, as well as the adjustment of metal-plastic windows and doors;
- eliminate leaks in window and door openings;
- purchase a thermometer in order to monitor the air temperature in heated rooms and timely adjust the operating mode of the building heating system;
- timely and fully carry out maintenance and scheduled preventive repairs of internal heat supply systems of buildings;
- perform routine repairs and insulation of building walls;
- eliminate uneven heating of the radiator surface, clean the radiators, drain the air;
- implement a water and electricity metering system with radio modules;
- implement a remote-controlled automated control system;
- to implement a system of administrative and organizational measures for water conservation;
- for administrative and industrial buildings - to install touch faucets with aerators, urinals with touch valves, as well as toilets with a split tank (with two drain buttons).
- implement automated water metering devices with data transmission via radio modules;
- carry out timely verification of water metering devices, timely maintenance of internal water supply networks and shut-off valves.

Organizational recommendations:

- Upon receipt of the Conclusion of the Energy Audit of JSC Kazakhtelecom facilities, the development of an Action Plan for energy conservation and energy efficiency improvement for a period of 5 years and approval of the schedule for allocating funds for their implementation as part of the long-term Development Plan;

- To implement energy-saving measures with the attraction of investments through the mechanism of energy service contracts and public-private partnerships. These mechanisms allow not only to reduce the cost of energy consumption, but also to reduce the cost of maintaining, for example, a lighting system, since for the duration of the energy service agreement (about 5 years), the lamps are guaranteed by the investor and, in case of failure, must be replaced at his expense.

1.1 FEASIBILITY STUDY AND JUSTIFICATION OF ENERGY SAVING AND ENERGY EFFICIENCY MEASURES

Based on the results of studying the provided data from the survey of energy audit facilities, analysis of energy consumption and the results of instrumental measurements, a set of measures for energy conservation and energy efficiency improvement has been developed:

1) Replacement of existing incandescent lamps with LED

2) replacement of window blocks with new energy-saving ones

3) increasing the efficiency of heat transfer from radiators to a heated room by covering the outer wall behind the radiator with a heat-reflecting screen;

4) adjustment of fittings and replacement of seals on window structures

For each event, a technical and economic calculation on energy saving was carried out based on the officially submitted commercial proposals of two potential suppliers.

The technical and economic calculation of energy saving and energy efficiency measures contains specific economic indicators according to international practice (net present value, internal rate of return, payback period).

1 Event "Modernization of the lighting system by replacing it with LED lamps in the Pavlodar branch of JSC Kazakhtelecom "

The Pavlodar branch uses incandescent lamps with a power of 60 watts and an E27 socket. The operational life of the lamps has come to an end and their replacement complies with the technical regulations for the maintenance of the lighting system.

The list of incandescent lamps to be replaced is given in Table 3.1.

Table3.1

Lamps to be replaced					**LED lamps**	
Installation location	**Lamp Type**	**Power, W**	**Quantity, pcs.**	**Working hours per year, hours**	**Power, W**	**Annual energy savings, kWh**
Pavlodar branch, ATE-570	Heatings 60 Watts	60	29	1460	13	1 990
Pavlodar branch, ATE-53	Heatings 60 Watts	60	29	1460	13	1 990
Aksu, ATE Management	Heatings 60 Watts	60	102	1460	13	6 999
Accu	Heatings 60 Watts	60	12	1460	13	823
Koktobe	Heatings 60 Watts	60	21	1460	13	1 441
Shcherbakty	Heatings 60 Watts	60	9	1460	13	618
			202			**13861**

Instead of 60-Watt incandescent lamps, a Eurolux LL-E A60 13W 230 4K E27 bulb is offered for installation, costing 900 tenge per piece.
https://kaspi.kz/shop/pZeurolux-ll-e-a60-13w-230-4k-e27-100142686/?c=710000000&utm source=google&utm medium=cpc&utm campaign=shop google search home lighting desktop&gbraid=0AAAAAC7-v7i7GjinuS1t2Sy4yFEHV9Be2&gclid=CjwKCAjwr5 CBhBlEiwAzfwYuCJJqKs2g4STzOyJcq2iVhMyCnuoSUQIKzCBnLM5y4aKuxWFQWIlaBoCqZUQAvD BwE

This lamp has technical and lighting characteristics not lower than an incandescent lamp of 60 watts.

Information on required investments and energy savings is summarized in Table 3.2.

Table3.2

Lamps to be replaced				LED lamp power, W	Investments, thousand tenge	Energy savings, kWh/year
Type	Power, W	Quantity	Number of working			
Накаливания 60 Вт	60	202	1460	13	181,8	13 861

The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.3-3.5.

The initial data for calculating the effectiveness of investments _____ Table 3.3

Indicator	**Mean**
Investments in the project, thousand tenge	181,800
Electricity tariff in 2025, tenge/kWh	29,200
Average rate increase per year, %	16,5%
Energy savings per year, thous. kWh	13,861
Discount rate (as of 02/14/2025), %	16,50%
Corporate income tax	20%
Service life, years	6

Production performance and cash flow from investments Table 3.4

Beginning of the forecast period	01.01. 2026	01.01. 2027	01.01. 2028	01.01. 2029	01.01. 2030	01.01. 2031	01.01. 2032
End of the forecast period	31.12. 2026	31.12. 2027	31.12. 2028	31.12. 2029	31.12. 2030	31.12. 2031	31.12. 2032
Calendar year/quarter	2026	2027	2028	2029	2030	2031	2032
Number of days in the period	365	365	366	365	365	365	366
Operating year number	-	1	2	3	4	5	6
Projected tariff per EE, tenge/kWh	34,018	39,631	46,170	53,788	62,663	73,003	85,048
Economic effect of the project implementation, thousand tenge	181,800	439,460	511,971	596,446	694,860	809,511	943,081
Free cash flow (FCFE), thousand tenge	-181,800	439,460	511,971	596,446	694,860	809,511	943,081
Accumulated cash flow, thousand tenge	-181,800	257,660	769,631	1366,08	2060,94	2870,45	3813,53
Discounted cash flow (Present Value), thousand	-181,800	377,219	377,219	377,219	377,219	377,219	377,219
Accumulated cash flow, thousand tenge	-181,800	195,419	572,638	949,856	1327,07	1704,29	2081,51

The results of calculating the effectiveness of investments in the project Table 3.5

Indicator	Mean
Net present value NPV of cash flows, thousand tenge	2081,513
Internal Rate of return (IRR), %	257,94%
Profitability Index (PI)	11,45
Simple payback period (PP), years	1
Discounted payback period (DPP), years	1

Conclusions:

1) The net present value of the event becomes positive according to the simple payback period - 1 year after the project implementation, according to the discounted payback period - 1 year after the project implementation;

2) The internal rate of return exceeds the accepted discount rate by more than 2%;

3) The payback period for investments is 1 year;

The event **"Replacement of incandescent lamps with LED lamps in the Pavlodar branch"** is economically feasible.

1.1 Event "Replacement of 600 mm fluorescent lamps with LED ones in the Pavlodar branch of JSC Kazakhtelecom"

Replacing tubular fluorescent lamps with LED ones is a widespread energy-saving measure that reduces electricity consumption by half, Figure 1.

Figure 1 - Replacement of tubular fluorescent lamps with LED analogues

The implementation of this event is carried out by the own efforts of the service company. To replace fluorescent lamps with LED lamps, it is necessary to remove the electronic controls and apply voltage directly to the terminals of the LED lamps, Figure 2.

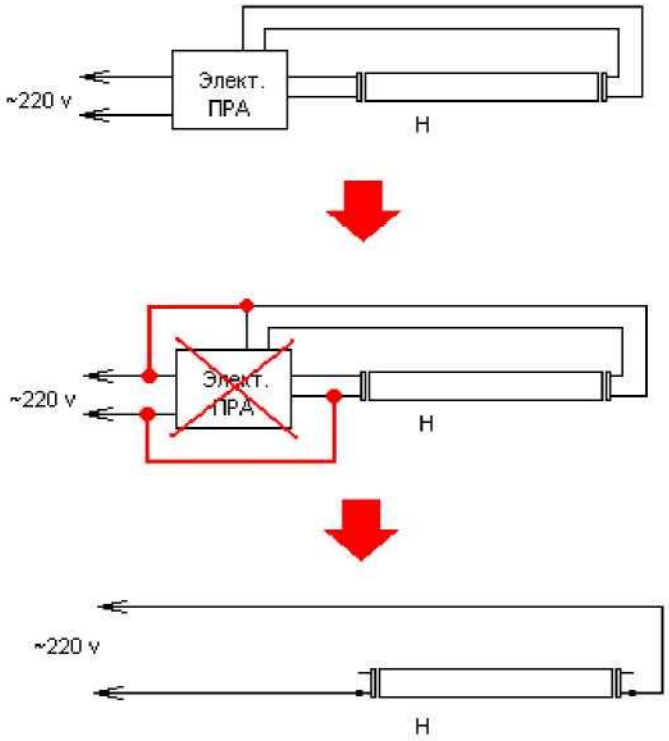

Figure 2. Removing electronic controls and connecting LED lamps

The list of fluorescent lamps in the fixtures to be replaced, as well as the resulting energy savings, are shown in Table 3.5.

Lamps to be replaced and energy savings to be achieved Table 3.5

Installation location	Lamps to be replaced				LED lamps	Annual energy savings, kWh
	Lamp type	Unit power, W	Quantity, pcs.	Working hours per year, hours	Unit power, W	
KMTO	Luminescent 600 mm	18	36	2920	9	946,08
Workshop, administrative building	Luminescent 600 mm	18	216	2920	9	5676,48
Bayanaul	Luminescent 600 mm	18	32	2920	9	840,96
Total:			**284**			**7 463,52**

LED lamps are offered for installation, with the following characteristics:
Lamp power - no more than 9 watts,
Base - G13,
The color temperature is at least 6500 K.,
The shape of the lamp bulb is Tubular,
Luminous flux - not less than 1600 lm,
Pipe diameter - not less than 26 mm,
Length - not less than 600 mm,
The average nominal service life is at least 20,000 hours.
An example of a suitable lamp
LED lamp 9W G13 T8 4000K 800Lm ST8B-0.6M 9W/840 230VAC tube 600mm DE 25X1 RU OSRAM 4058075377486, product link:
https://minimaks.kz/product/lampa-svetodiodnaya-st8b-0-6m-9w-840-230vac-de-25x1- g13-ruosram-4058075377486/
The price for 1 piece is 1,942 tenge.
Thus, the implementation of the event "Replacement of 600 mm fluorescent lamps with LED lamps in the Pavlodar branch" requires investments in the amount of 552 thousand tenge.
The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.6-3.8.

The initial data for calculating the effectiveness of investments Table 3.6

Indicator	Mean
Investments in the project, thousand tenge	552,000
Electricity tariff in 2023, tenge/kWh	29,200
Average rate increases per year, %	16,5%
Energy savings per year, thous. kWh	7,4635
Discount rate (as of 02/14/2025), %	16,50%
Corporate income tax	20%
Service life, years	6

Production performance and cash flow from investments Table 3.7

Beginning of the forecast period	01.01. 2026	01.01. 2027	01.01. 2028	01.01. 2029	01.01. 2030	01.01. 2031	01.01. 2032
End of the forecast period	31.12. 2026	31.12. 2027	31.12. 2028	31.12. 2029	31.12. 2030	31.12. 2031	31.12. 2032
Calendar year/quarter	2026	2027	2028	2029	2030	2031	2032
Number of days in the period	365	365	366	365	365	365	366
Operating year number	-	1	2	3	4	5	6
Projected tariff per EE, tenge/kWh	34,018	39,631	46,170	53,788	62,663	73,003	85,048
Economic effect of the project implementation, thousand tenge	552,00 0	236,62 9	275,67 3	321,15 9	374,15 0	435,88 5	507,80 6
Free cash flow (FCFE), thousand tenge	- 552,00 0	236,62 9	275,67 3	321,15 9	374,15 0	435,88 5	507,80 6
Accumulated cash flow, thousand tenge	- 552,00 0	- 315,37 1	- 39,698	281,46 1	655,61 2	1091,4 97	1599,3 03
Discounted cash flow (Present Value), thousand tenge	- 552,00 0	203,11 5	203,11 5	203,11 5	203,11 5	203,11 5	203,11 5
Accumulated cash flow, thousand tenge	- 552,00 0	- 348,88 5	- 145,77 0	57,346	260,46 1	463,57 6	666,69 1

The results of calculating the effectiveness of investments in the project Table 3.8

Indicator	**Mean**
Net present value NPV of cash flows, thousands of tenge	666,691
Internal Rate of return (IRR), %	49,93%
Profitability Index (PI)	1,21
Simple payback period (PP), years	3
Discounted payback period (DPP), years	3

Conclusions:

4) The net present value of the event becomes positive according to the simple payback period - 3 years after the project implementation, according to the discounted payback period - 3 years after the project implementation;

5) The internal rate of return exceeds the accepted discount rate by more than 2%;

6) The payback period for investments is 3 years;

7) The event **"Replacement of 600 mm fluorescent lamps with LED lamps in the Pavlodar branch"** is economically feasible.

1.2 Event "Replacement of 1200 mm fluorescent lamps with LED lamps in Pavlodar branch"

Replacing tubular fluorescent lamps with LED ones is a widespread energy-saving measure that reduces electricity consumption by half, Figure 1.

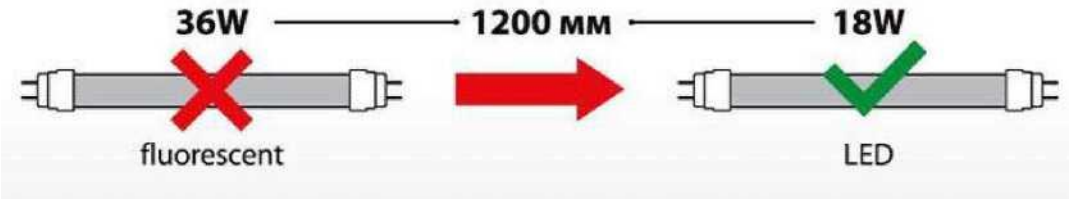

Figure 1 - Replacement of tubular fluorescent lamps with LED analogues

The implementation of this event is carried out by the own efforts of the service company. To replace fluorescent lamps with LED lamps, it is necessary to remove the electronic controls and apply voltage directly to the terminals of the LED lamps, Figure 2.

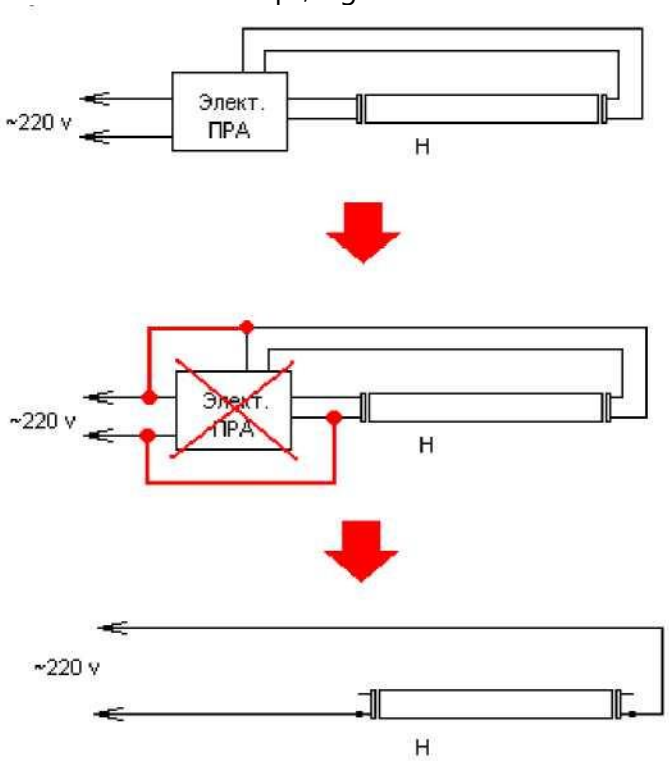

Figure 2. Removing electronic controls and connecting LED lamps

The list of fluorescent lamps in the fixtures to be replaced, as well as the resulting energy savings, are shown in Table 1.

Lamps to be replaced and energy savings to be achieved Table 3.9

Installation location	Lamps to be replaced				LED lamps	Annual energy savings, kWh Quantity, pcs.
	Lamp type	Unit power, W	Quantity, pcs.	Lamp type	Unit power, W	
ATE-53	Luminescent 1200 mm	36	33	29200	18	1734,48
workshop, administrative building	Luminescent 1200 mm	36	308	29200	18	16188,48

ATE-34	Luminescent 1200 mm	36	300	29200	18	15768
Total:			**641**			**33 690,9**

LED lamps are offered for installation, with the following characteristics:
Lamp power - no more than 18 watts,
Base - G13,
The color temperature is at least 6500 K.,
The shape of the lamp bulb is Tubular,
Luminous flux - not less than 1600 lm,
Pipe diameter - not less than 26 mm,
Length - not less than 1198 mm,
The average nominal service life is at least 20,000 hours.
An example of a suitable lamp
LED lamp 18W G13 LED T8 6500K 1600Lm ST8B-1.2M 18W/865 230V tube 1200mm RU OSRAM 4058075377561, product link:
https://minimaks.kz/product/lampa-svetodiodnaya-st8b-1-2m-18w-865-230vac-de- 25x1 -g13-ruosram-4058075377561/
The price for 1 piece is 2,454 tenge.
Thus, the implementation of the event "Replacement of 1200 mm fluorescent lamps with LED lamps in the Pavlodar branch" requires investments in the amount of 1,573 thousand tenge.
The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.10-3.12.

The initial data for calculating the effectiveness of investments Table3.10

Indicator	**Mean**
Investments in the project, thousand tenge	1573,000
Electricity tariff in 2025, tenge/kWh	29,200
Average rate increase per year, %	16,5%
Energy savings per year, thous. kWh	33,691
Discount rate (as of 02/14/2025), %	16,50%
Corporate income tax	20%
Service life, years	6

Production performance and cash flow from investments _____ Table 3.11

Beginning of the forecast period	01.01. 2026	01.01. 2027	01.01. 2028	01.01. 2029	01.01. 2030	01.01. 2031	01.01. 2032
End of the forecast period	31.12. 2026	31.12. 2027	31.12. 2028	31.12. 2029	31.12. 2030	31.12. 2031	31.12. 2032
Calendar year/quarter	2026	2027	2028	2029	2030	2031	2032
Number of days in the period	365	365	366	365	365	365	366
Operating year number	-	1	2	3	4	5	6
Projected tariff per EE, tenge/kWh	34,01 8	39,63 1	46,17 0	53,78 8	62,66 3	73,00 3	85,04 8
Economic effect of the project implementation, thousand tenge	1573, 000	1068, 164	1244, 411	1449, 739	1688, 946	1967, 622	2292, 280
Free cash flow (FCFE), thousand tenge	- 1573, 000	1068, 164	1244, 411	1449, 739	1688, 946	1967, 622	2292, 280
Accumulated cash flow, thousand tenge	- 1573, 000	- 504,8 36	739,5 76	2189, 315	3878, 261	5845, 884	8138, 164
Discounted cash flow (Present Value), thousand tenge	- 1573, 000	916,8 79	916,8 79	916,8 79	916,8 79	916,8 79	916,8 79
Accumulated cash flow, thousand tenge	- 1573, 000	- 656,1 21	260,7 59	1177, 638	2094, 517	3011, 396	3928, 276

The results of calculating the effectiveness of investments in the project _____ Table 3.12

Indicator	Mean
Net present value NPV of cash flows, thousands of tenge	3928,276
Internal rate of return (IRR), %	79,30%
Profitability Index (PI)	2,50
Simple payback period (PP), years	2
Discounted payback period (DPP), years	2

Conclusions:

1) The net present value of the event becomes positive according to the simple payback period - 2 years after the project implementation, according to the discounted payback period - 2 years after the project implementation;

2) The internal rate of return exceeds the accepted discount rate by more than 2%;

3) The investment payback period is 2 years;

4) The event **"Replacement of 1200 mm fluorescent lamps with LED lamps in the Pavlodar branch**" is economically feasible.

1.3 Event "Replacement of 1200 mm fluorescent lamps with LED ones in the North Kazakhstan branch of JSC Kazakhtelecom"

Replacing tubular fluorescent lamps with LED ones is a widespread energy-saving measure that reduces electricity consumption by half, Figure 1.

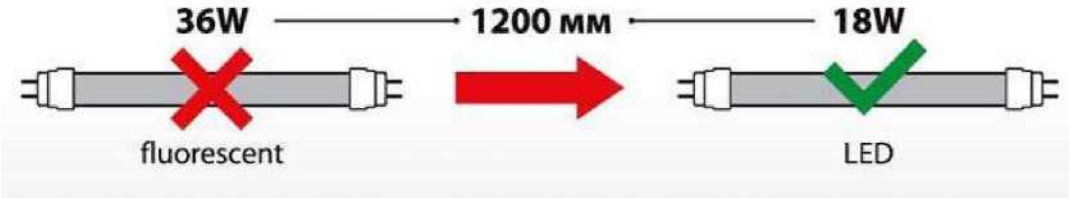

Figure 1 - Replacement of tubular fluorescent lamps with LED analogues

The implementation of this event is carried out by the own efforts of the service company. To replace fluorescent lamps with LED lamps, it is necessary to remove the electronic controls and apply voltage directly to the terminals of the LED lamps, Figure 2.

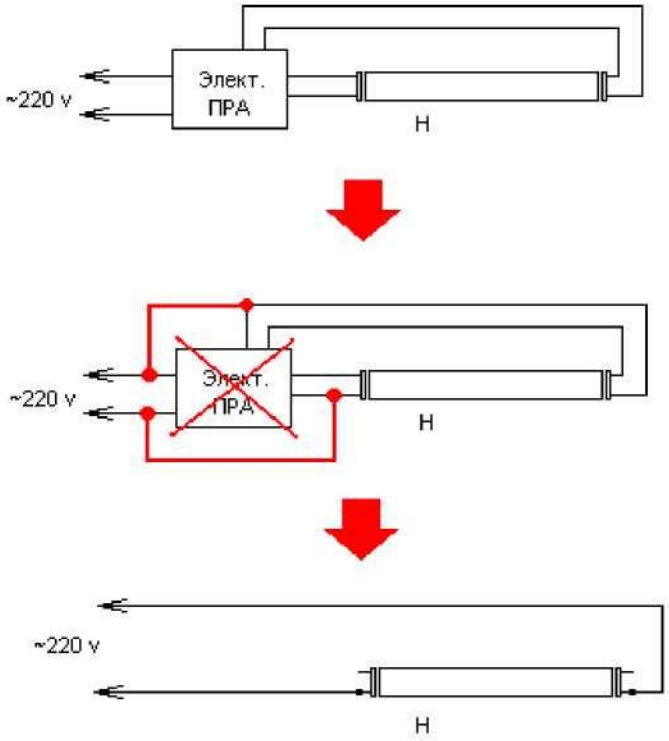

Figure 2. Removing electronic controls and connecting LED lamps

The list of fluorescent lamps in the fixtures to be replaced, as well as the resulting energy savings, are shown in Table 1.

Lamps to be replaced and energy savings to be achieved _____ Table 3.13

Installation location	**Lamps to be replaced**				**LED lamps**	**Annual energy savings, kWh**
	Lamp type	**Unit power, W**	**Quantity, pcs.**	**Lamp type**	**Unit power, W**	
ATE-46	Fluorescent lamp 1200 mm	36	466	3650	18	30616,2
ATE-34	Fluorescent lamp 1200 mm	36	36	1825	18	1182,6
Kyzylzhar, Bishkul	Fluorescent lamp 1200 mm	36	46	2920	18	2417,76
Akkayinsky district, village Smirnovo	Fluorescent lamp 1200 mm	36	30	730	18	394,2
Akzhar district, Talshik village	Fluorescent lamp 1200 mm	36	8	8760	18	1261,44
Akzhar district, Talshik village	Fluorescent lamp 1200 mm	36	66	2920	18	3468,96
Akzhar district, Talshik village	Fluorescent lamp 1200 mm	36	11	1460	18	289,08
Zhambyl district, Presnovka village	Fluorescent lamp 1200 mm	36	38	2920	18	1997,28
Ualikhanov district, village Kishkenkol	Fluorescent lamp 1200 mm	36	28	2920	18	1471,68
LTC Mamlyutka	Fluorescent lamp 1200 mm	36	60	2920	18	3153,6
Total:			**789**			**46 252,8**

LED lamps are offered for installation, with the following characteristics:
Lamp power - no more than 18 watts,
Base - G13,
The color temperature is at least 6500 K.,
The shape of the lamp bulb is Tubular,
Luminous flux - not less than 1600 lm,
Pipe diameter - no more than 26 mm,

Length - not less than 1198 mm,

The average nominal service life is at least 20,000 hours.

An example of a suitable lamp

LED lamp 18W G13 LED T8 6500K 1600Lm ST8B-1.2M 18W/865 230V tube 1200mm RU OSRAM 4058075377561, product link:

https://minimaks.kz/product/lampa-svetodiodnaya-st8b-1-2m-18w-865-230vac-de- 25x1 -g13-ruosram-4058075377561/

The price for 1 piece is 2,454 tenge.

Thus, the implementation of the event "Replacement of 1200 mm fluorescent lamps with LED lamps in the North Kazakhstan branch" requires investments in the amount of 1,937 thousand tenge.

The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.14-3.16.

The initial data for calculating the effectiveness of investments Table3.14

Indicator	**Mean**
Investments in the project, thousand tenge	1937,000
Electricity tariff in 2025, tenge/kWh	25,880
Average rate increase per year, %	16,5%
Energy savings per year, thous. kWh	46,2528
Discount rate (as of 02/14/2025), %	16,50%
Corporate income tax	20%
Service life, years	1937,000

Production performance and cash flow from investments . Table3.15

Beginning of the forecast period	01.01. 2026	01.01. 2027	01.01. 2028	01.01. 2029	01.01. 2030	01.01. 2031	01.01. 2032
End of the forecast period	31.12. 2026	31.12. 2027	31.12. 2028	31.12. 2029	31.12. 2030	31.12. 2031	31.12. 2032
Calendar year/quarter	2026	2027	2028	2029	2030	2031	2032
Number of days in the period	365	365	366	365	365	365	366
Operating year number	-	1	2	3	4	5	6
Projected tariff per EE, tenge/kWh	30,15 0	35,12 5	40,92 1	47,67 3	55,53 8	64,70 2	75,37 8
Economic effect of the project implementation, thousand tenge	1937, 000	1299, 703	1514, 154	1763, 989	2055, 048	2394, 131	2789, 162
Free cash flow (FCFE), thousand tenge	- 1937, 000	1299, 703	1514, 154	1763, 989	2055, 048	2394, 131	2789, 162
Accumulated cash flow, thousand tenge	- 1937, 000	- 637,2 97	876,8 57	2640, 847	4695, 894	7090, 025	9879, 187
Discounted cash flow (Present Value), thousand tenge	- 1937, 000	1115, 625	1115, 625	1115, 625	1115, 625	1115, 625	1115, 625
Accumulated cash flow, thousand tenge	- 1937, 000	- 821,3 75	294,2 50	1409, 875	2525, 500	3641, 125	4756, 750

The results of calculating the effectiveness of investments in the project _____ Table 3.16

Indicator	**Mean**
Net present value NPV of cash flows, thousands of tenge	4756,750
Internal Rate of return (IRR), %	78,39%
Profitability Index (PI)	2,46
Simple payback period (PP), years	2
Discounted payback period (DPP), years	2

Conclusions:

1) The net present value of the event becomes positive according to the simple payback period - 2 years after the project implementation, according to the discounted payback period - 2 years after the project implementation;

2) The internal rate of return exceeds the accepted discount rate by more than 2%;

3) The investment payback period is 2 years;

4) The event **"Replacement of 1200 mm fluorescent lamps with LED lamps in the North Kazakhstan branch"** is economically feasible.

1.4 Event "Replacement of 600 mm fluorescent lamps with LED ones in the North Kazakhstan branch of JSC Kazakhtelecom"

Replacing tubular fluorescent lamps with LED ones is a widespread energy-saving measure that reduces electricity consumption by half, Figure 1.

Figure 1 - Replacement of tubular fluorescent lamps with LED analogues

The implementation of this event is carried out by the own efforts of the service company. To replace fluorescent lamps with LED lamps, it is necessary to remove the electronic controls and apply voltage directly to the terminals of the LED lamps, Figure 2.

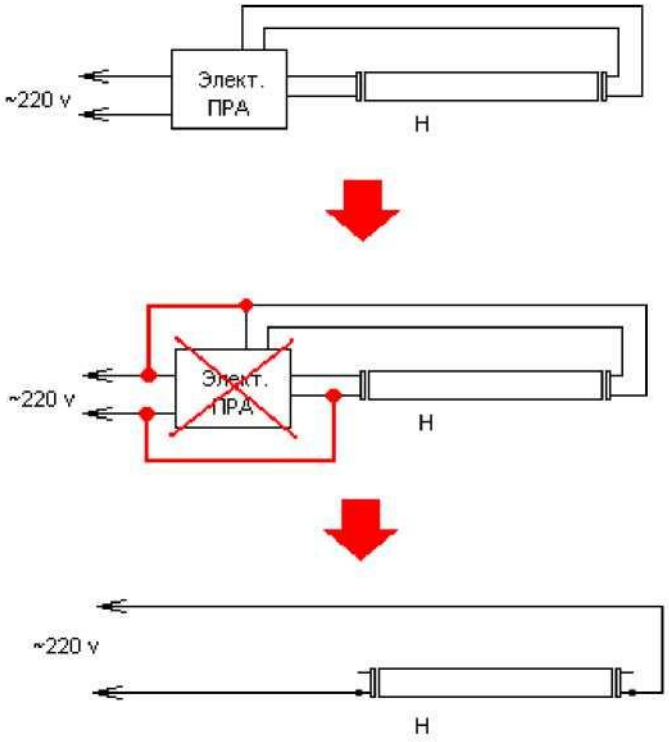

Figure 2. Removing electronic controls and connecting LED lamps

The list of fluorescent lamps in the fixtures to be replaced, as well as the resulting energy savings, are shown in Table 1.

Lamps to be replaced and energy savings to be achieved Table 3.17

Installation location	**Lamps to be replaced**				**LED lamps**	**Annual energy savings, kWh**
	Lamp type	**Unit power, W**	**Quantity, pcs.**	**Lamp type**	**Unit power, W**	
ATE-34	Fluorescent lamp 600 mm	18	44	1825	9	722,7
Kyzylzhar, Bishkul	Fluorescent lamp 600 mm	18	32	2920	9	840,96
Akkayinsky district, village Smirnov	Fluorescent lamp 600 mm	18	40	2920	9	1051,2
Akzhar district, Talshik village	Fluorescent lamp 600 mm	18	84	2920	9	2207,52
Yesilsky district, village Yavlenka	Fluorescent lamp 600 mm	18	112	1460	9	1471,68
Timiryazevo	Fluorescent lamp 600 mm	18	124	2190	9	2444,04
Ualikhanov district, village Kishkenkols	Fluorescent lamp 600 mm	18	164	2920	9	4309,92
Novoishimovskoye	Fluorescent lamp 600 mm	18	56	1460	9	735,84
LTC Mamlyutka	Fluorescent lamp 600 mm	18	120	2920	9	3153,6
Total			**776**			**16 937,46**

LED lamps are offered for installation, with the following characteristics:
Lamp power - no more than 9 watts,
Base - G13,
The color temperature is at least 6500 K.,
The shape of the lamp bulb is Tubular,
Luminous flux - not less than 1600 lm,
Pipe diameter - not less than 26 mm,
Length - not less than 600 mm,
The average nominal service life is at least 20,000 hours.
An example of a suitable lamp
LED lamp 9W G13 T8 4000K 800Lm ST8B-0.6M 9W/840 230VAC tube 600mm DE 25X1 RU OSRAM 4058075377486, product link:

https://minimaks.kz/product/lampa-svetodiodnaya-st8b-0-6m-9w-840-230vac-de-25x1-g13-ruosram-4058075377486/

The price for 1 piece is 1,942 tenge.

Thus, the implementation of the event "Replacement of 600 mm fluorescent lamps with LED lamps in the North Kazakhstan branch" requires investments in the amount of 1,507 thousand tenge.

The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.18-3.20.

The initial data for calculating the effectiveness of investments _____ Table 3.18

Indicator	**Mean**
Investments in the project, thousand tenge	1507,000
Electricity tariff in 2023, tenge/kWh	25,880
Average rate increases per year, %	16,5%
Energy savings per year, thous. kWh	16,9375
Discount rate (as of 02/14/2025), %	16,50%
Corporate income tax	20%
Service life, years	6

Production performance and cash flow from investments _____ . Table 3.19

Beginning of the forecast period	01.01. 2026	01.01. 2027	01.01. 2028	01.01. 2029	01.01. 2030	01.01. 2031	01.01. 2032
End of the forecast period	31.12. 2026	31.12. 2027	31.12. 2028	31.12. 2029	31.12. 2030	31.12. 2031	31.12. 2032
Calendar year/quarter	2026	2027	2028	2029	2030	2031	2032
Number of days in the period	365	365	366	365	365	365	366
Operating year number	-	1	2	3	4	5	6
Projected tariff per EE, tenge/kWh	30,15 0	35,12 5	40,92 1	47,67 3	55,53 8	64,70 2	75,37 8
Economic effect of the project implementation, thousand tenge	1507, 000	475,9 42	554,4 73	645,9 61	752,5 44	876,7 14	1021, 372
Free cash flow (FCFE), thousand tenge	- 1507, 000	475,9 42	554,4 73	645,9 61	752,5 44	876,7 14	1021, 372
Accumulated cash flow, thousand tenge	- 1507, 000	- 1031, 058	- 476,5 85	169,3 76	921,9 21	1798, 635	2820, 007
Discounted cash flow (Present Value), thousand tenge	- 1507, 000	408,5 34	408,5 34	408,5 34	408,5 34	408,5 34	408,5 34
Accumulated cash flow, thousand tenge	- 1507, 000	- 1098, 466	- 689,9 32	- 281,3 97	127,1 37	535,6 71	944,2 05

The results of calculating the effectiveness of investments in the project _____ Table3.20

Indicator	Mean
Net present value NPV of cash flows, thousands of tenge	944,205
Internal Rate of return (IRR), %	35,09%
Profitability Index (PI)	0,63
Simple payback period (PP), years	3
Discounted payback period (DPP), years	4

Conclusions:

9) The net present value of the event becomes positive according to the simple payback period - 3 years after the project implementation, according to the discounted payback period - 4 years after the project implementation;

10) The internal rate of return exceeds the accepted discount rate by more than 2%;

11) The payback period for investments is 4 years;

12) The event **"Replacement of 600 mm fluorescent lamps with LED lamps in the North Kazakhstan branch"** is economically feasible.

1.5 Event "Replacement of 1200 mm fluorescent lamps with LED ones in the East Kazakhstan branch of JSC Kazakhtelecom"

Replacing tubular fluorescent lamps with LED ones is a widespread energy-saving measure that reduces electricity consumption by half, Figure 1.

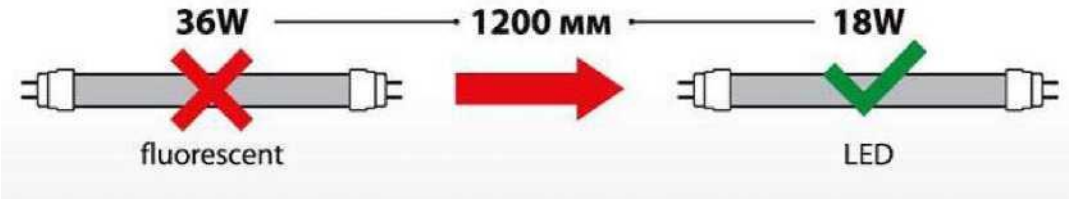

Figure 1 - Replacement of tubular fluorescent lamps with LED analogues

The implementation of this event is carried out by the own efforts of the service company. To replace fluorescent lamps with LED lamps, it is necessary to remove the electronic controls and apply voltage directly to the terminals of the LED lamps, Figure 2.

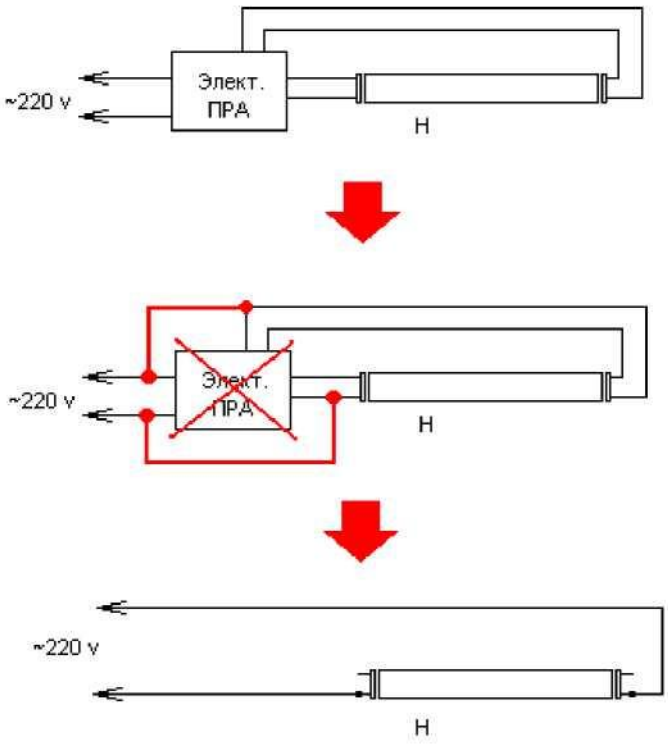

Figure 2. Removing electronic controls and connecting LED lamps

The list of fluorescent lamps in the fixtures to be replaced, as well as the resulting energy savings, are shown in Table 1.

Lamps to be replaced and energy savings to be achieved _____ Table 3.21

Installation location	Lamps to be replaced			LED lamps		Annual energy savings, kWh Quantity, pcs.
	Lamp type	Unit power, W	Quantity, pcs.	Lamp type	Unit power, W	
East Kazakhstan	Luminescent 1200 mm	36	811	1460	18	21 313,08

LED lamps are offered for installation, with the following characteristics: Lamp power - no more than 18 watts, Base - G13,

The color temperature is at least 6500 K.,

The shape of the lamp bulb is Tubular,

Luminous flux - not less than 1600 lm,

Pipe diameter - no more than 26 mm,

Length - not less than 1198 mm,

The average nominal service life is at least 20,000 hours.

An example of a suitable lamp

LED lamp 18W G13 LED T8 6500K 1600Lm ST8B-1.2M 18W/865 230V tube 1200mm RU OSRAM 4058075377561, product link:

https://minimaks.kz/product/lampa-svetodiodnaya-st8b-1-2m-18w-865-230vac-de- 25x1 -g13-ruosram-4058075377561/

The price for 1 piece is 2,454 tenge.

Thus, the implementation of the event "Replacement of 1200 mm fluorescent lamps with LED lamps in the Pavlodar branch" requires investments in the amount of 1,991 thousand tenge.

The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.22-3.24..

The initial data for calculating the effectiveness of investments _____Table 3.22

Indicator	Mean
Investments in the project, thousand tenge	1991,000
Electricity tariff in 2025, tenge/kWh	33,540
Average rate increase per year, %	16,5%
Energy savings per year, thous. kWh	21,3131
Discount rate (as of 02/14/2025), %	16,50%
Corporate income tax	20%
Service life, years	6

Production performance and cash flow from investments _____ Table 3.23

Beginning of the forecast period	01.01. 2026	01.01. 2027	01.01. 2028	01.01. 2029	01.01. 2030	01.01. 2031	01.01. 2032
End of the forecast period	31.12. 2026	31.12. 2027	31.12. 2028	31.12. 2029	31.12. 2030	31.12. 2031	31.12. 2032
Calendar year/quarter	2026	2027	2028	2029	2030	2031	2032
Number of days in the period	365	365	366	365	365	365	366
Operating year number	-	1	2	3	4	5	6
Projected tariff per EE, tenge/kWh	39,07 4	45,52 1	53,03 2	61,78 3	71,97 7	83,85 3	97,68 9
Economic effect of the project implementation, thousand tenge	1991, 000	776,1 60	904,2 26	1053, 423	1227, 238	1429, 733	1665, 638
Free cash flow (FCFE), thousand tenge	- 1991, 000	776,1 60	904,2 26	1053, 423	1227, 238	1429, 733	1665, 638
Accumulated cash flow, thousand tenge	- 1991, 000	- 1214, 840	- 310,6 14	742,8 09	1970, 047	3399, 780	5065, 419
Discounted cash flow (Present Value), thousand tenge	- 1991, 000	666,2 32	666,2 32	666,2 32	666,2 32	666,2 32	666,2 32
Accumulated cash flow, thousand tenge	- 1991, 000	- 1324, 768	- 658,5 4	7,695	673,9 26	1340, 158	2006, 389

The results of calculating the effectiveness of investments in the project _____ Table 3.24

Indicator	**Mean**
Net present value NPV of cash flows, thousands of tenge	2006,389
Internal Rate of return (IRR), %	44,99%
Profitability Index (PI)	1,01
Simple payback period (PP), years	3
Discounted payback period (DPP), years	3

Conclusions:

1) The net present value of the event becomes positive according to the simple payback period - 3 years after the project implementation, according to the discounted payback period - 3 years after the project implementation;

2) The internal rate of return exceeds the accepted discount rate by more than 2%;

3) The payback period for investments is 3 years;

4) The event **"Replacement of 1200 mm fluorescent lamps with LED lamps in the East Kazakhstan branch"** is economically feasible.

When applying the above measures in the branches, the total electric energy savings of JSC Kazakhtelecom will be 139,518.8 kWh/year.

Table 3.25

No.	Branch	Name of the event	Savings, kWh/year	Savings, thousand tenge/year	Investments, thousand tenge
1.	Pavlodar region SF	Replacement of incandescent lamps with LED lamps	13 861	404,7	181,8
		"Replacement of 600 mm fluorescent lamps with LED	7 463,5	217,9	552,0
		Replacement of 1200 mm fluorescent lamps with LED	33 690,9	983,8	1 573,0
		Total	**55 015,4**	**1606,4**	**2 306,8**
2.	North Kazakhstan region SF	"Replacement of 600 mm fluorescent lamps with LED	16 937,5	438,3	1 507,0
		Replacement of 1200 mm fluorescent lamps with LED	46 252,8	1197,0	1937,0
		Total	**63 190,3**	**1635,3**	**3 444,0**
3.	East Kazakhstan region	Replacement of 1200 mm fluorescent lamps with LED	21 313,08	714,8	1991,0
		Total:	**21 313,08**	**714,8**	**1991,0**
		In total :	**139 518,8**	**3956,5**	**7 741,8**

2 Event "Replacement of window blocks (profiles) with new energy-saving ones"

The purpose of replacing window blocks is to reduce heat loss through window blocks. The result is a reduction in the consumption of electric energy for heating.

During the inspection at some facilities of JSC Kazakhtelecom , there is no glazing, the windows are in a broken state, or together with glass, plywood, boards or other

improvised materials are installed on the windows.

Measurements of the thermal flow meter for the thermal resistance of double-glazed windows were carried out at the facilities of JSC Kazakhtelecom . According to the measurement results, the average coefficient of thermal resistance of the installed window blocks was R=0.247 m2*0C/W. The thermal resistance of window blocks does not correspond to CH RK 2.04-212004 ENERGY CONSUMPTION AND THERMAL PROTECTION OF CIVIL BUILDINGS, the normalized thermal resistance of window blocks is on average for JSC Kazakhtelecom facilities, according to the established CH RK 2.04-21-2004 must be at least R=0.418 m2 *0C/W. Low-quality window blocks lead to increased heat losses and overconsumption

of natural gas for heating the building.

Based on the above, it is necessary to replace outdated window blocks that do not comply with building regulations with modern energy-saving ones (Fig. 3.3). It is recommended to install a PVC profile from a 3-chamber/ 4-chamber profile system with a high level of heat conservation. Double-glazed windows with 3 / 4 chambers, the thickness should be at least 44mm (recommended thickness 52mm) and have energy-saving coating, the heat transfer resistance should be at least 0.45 m2 * 0C /W. The characteristics of the analogues must be similar or better than the specified characteristics.

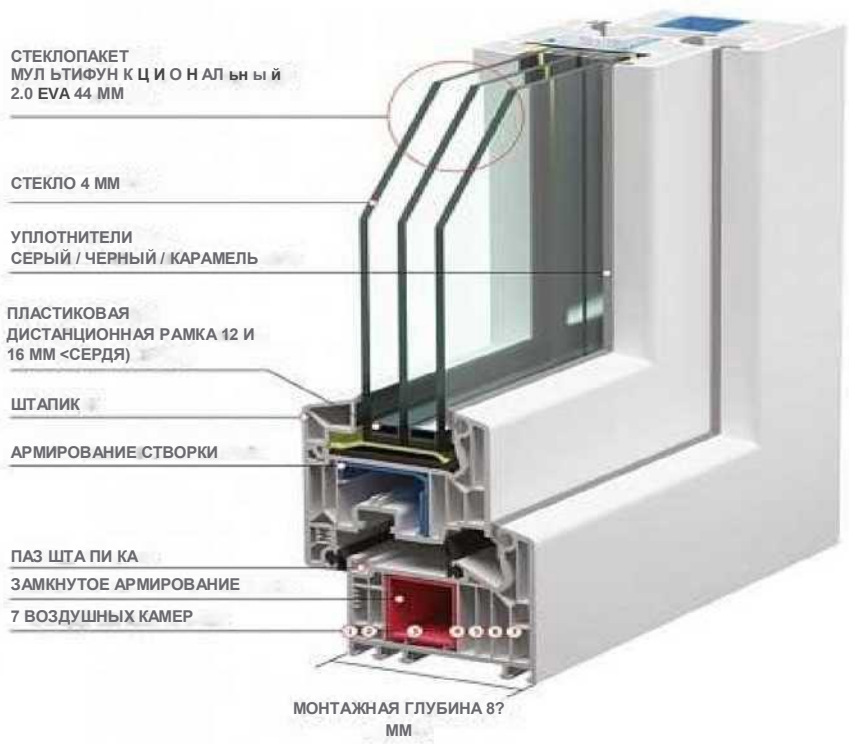

Figure 3.3

The main advantages of this profile are:

- class A profile with a wall thickness of at least 3 mm;
- profile width 82mm;
- Energy-saving function;
- the possibility of installing double-glazed windows up to 52mm wide.

The table below summarizes the required number of window replacements in the buildings of JSC Kazakhtelecom .

Table 3.26

No.	Name of the PB	Number of windows
1	Almaty region	179
2	West Kazakhstan region	154
3	Zhambyl region SF	21
4	Turkestan region SF	320
5	Atyrau region SF	105
6	Aktobe region SF	161
7	Mangystau region SF	30
	Total:	**970**

Calculation of thermal energy savings for heating due to the installation of modern energy-saving window profiles

$Q_{тп} = K_{ок} * S_{ОКОН} * (t_{вн} — t_{ср\ от}) * n * 24/1,163/10_6$, Gcal/year

where,

$K_{ок}$ - window heat transfer coefficient, W/m2 *0C;

$S_{ОКОН}$ - total window glazing area, m2;

$t_{вн}$ - estimated internal temperature, 0C;
$t_{ср\ от}$ - average temperature of the heating period, 0C;
n - number of days of the heating period.

Table 3.27

No.	Name of PB	$Q_{тп}$, saving thermal energy
1	Almaty region	507,1
2	West Kazakhstan region	95,5
3	Zhambyl region SF	129,0
4	Turkestan region SF	895,0
5	Atyrau region SF	122,5
6	Aktobe region SF	130,5
7	Mangystau region SF	69,1
	Total:	**1948,7**

Result: The expected savings in thermal energy (natural gas) from the introduction of energy-saving measures in the branch of the Almaty region will approximately amount to 507.1 **Gcal/year**, or 2,396.8 **thousand tenge/year** with an average weighted tariff for natural gas in 2025 of **4726.5** tenge/Gcal.

The initial data and results of calculating the efficiency of investments in the replacement of window blocks with energy-saving window blocks for the branch of JSC Kazakhtelecom in the Almaty region are given in Table 3.28-3.30.

The initial data for calculating the effectiveness of investments Table 3.28

Investments in the project, thousand tenge	17 363,0
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	6,3
Discount rate (as of 02/14/2025), %	16,5%
Consumer Price index (by April 2025), %	10,7%
Corporate income tax, %	20
Equipment service life, years	5

* Current retail prices of commercial gas for consumers of QAZAQGAZ AIMAQ JSC from July 1, 2024

Production performance and cash flow from investments Table 3.29

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	5
The volume of reduction in heat consumption, Gcal	0,5071	0,5071	0,5071	0,5071	0,5071	0,5071
Projected cost of gas, thousand tenge/m3	4,73	5,23	5,79	6,41	7,10	4,73
Economic effect of the project implementation, thousand tenge	1,92	2,122	2,349	2,601	2,879	1,92
Free cash flow (FCFE), thousand tenge	-1,917	2,122	2,349	2,601	2,879	-1,917
Accumulated cash flow, thousand tenge	-1,917	0,205	2,555	5,156	8,035	-1,917
Discounted cash flow (Current value-Present Value), thousand tenge	-1,917	1,822	1,731	1,645	1,563	-1,917
Accumulated cash flow, thousand tenge	-1,917	-0,095	1,636	3,281	4,844	-1,917

Table 3.30 The results of the calculation of investment efficiency

Net present value NPV of cash flows, thousands of tenge	12,72
Internal rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;

2) The simple payback period for investments is less than 5 years;

3) The event is appropriate

Result: The expected savings in thermal energy (natural gas) from the introduction of energy-saving measures in the branch of JSC Kazakhtelecom of the West Kazakhstan region will approximately amount to 95.5 **Gcal/year**, or 253.9 **thousand tenge/year** with an average weighted tariff for natural gas in 2025 of 2659.6 tenge/Gcal. The initial data and results of calculating the efficiency of investments in the event of replacing window blocks with energy-saving window blocks for the branch of JSC "Kaazkhtelecom" in the West Kazakhstan region are given in Table 3.14-3.16.

Table 3.31 The initial data for calculating the effectiveness of investments by branch

Investments in the project, thousand tenge	10 764,6
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	2,66
Discount rate (as of 02/14/2025), %	16,50%
Consumer Price index (by April 2025), %	10,70%
Corporate income tax, %	20%
Equipment service life, years	5

* Current retail prices of commercial gas for consumers of QAZAQGAZ AIMAQ JSC from July 1, 2024

Table 3.32 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	-
The volume of reduction in heat consumption, Gcal	0,0955	0,0955	0,0955	0,0955	0,0955	0,0955
Projected cost of gas, thousand tenge/m3	2,66	2,94	3,26	3,61	3,99	2,94
Economic effect of the project implementation, thousand tenge	0,23	0,252	0,279	0,309	0,342	0,23
Free cash flow (FCFE), thousand tenge	-0,228	0,252	0,279	0,309	0,342	-0,228
Accumulated cash flow, thousand tenge	-0,228	0,024	0,303	0,612	0,954	-0,228
Discounted cash flow (Current value-Present Value), thousand tenge	-0,228	0,216	0,205	0,195	0,186	-0,228
Accumulated cash flow, thousand tenge	-0,227	-0,011	0,194	0,389	0,575	-0,227

Net present value NPV of cash flows, thousands of tenge	1,51
Internal Rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;
2) The simple payback period for investments is less than 5 years;
3) The event is appropriate

Result: The expected savings in thermal energy (natural gas) from the introduction of energy-saving measures in the branch of JSC Kazakhtelecom of Zhambyl region will approximately amount to 129 **Gcal/year**, or 682.0 **thousand tenge/year** with an average weighted tariff for natural gas in 2025 5287.3 tenge/Gcal. The initial data and results of calculating the efficiency of investments in the replacement of window blocks with energy-saving window blocks for the branch of JSC Kazakhtelecom in Zhambyl region are given in Table 3.33-3.35.

Table 3.33 The initial data for calculating the effectiveness of investments by branch

Investments in the project, thousand tenge	2037,0
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	5,3
Discount rate (as of 02/14/2025), %	16,50%
Consumer Price index (by April 2025), %	10,70%
Corporate income tax, %	20%
Equipment service life, years	5

* Current retail prices of commercial gas for consumers of QAZAQGAZ AIMAQ JSC from July 1, 2024

Table 3.34 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	-

The volume of reduction in heat consumption, Gcal	0,129	0,129	0,129	0,129	0,129	0,129
Projected cost of gas, thousand tenge/m3	5,30	5,87	6,49	7,19	7,96	5,30
Economic effect of the project implementation, thousand tenge	0,55	0,605	0,670	0,742	0,821	0,55
Free cash flow (FCFE), thousand tenge	-0,547	0,605	0,670	0,742	0,821	-0,547
Accumulated cash flow, thousand tenge	-0,547	0,059	0,729	1,471	2,292	-0,547
Discounted cash flow (Current value-Present Value), thousand tenge	-0,547	0,520	0,494	0,469	0,446	-0,547
Accumulated cash flow, thousand tenge	-0,547	-0,027	0,467	0,936	1,382	-0,547

Table3.35

Net present value NPV of cash flows, thousand tenge	3,63
Internal Rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;
2) The simple payback period for investments is less than 5 years;
3) The event is appropriate

Result: The expected savings of thermal energy (natural gas) from the introduction of energy-saving measures in the branch of JSC Kazakhtelecom of the Turkestan region will approximately amount to 895.0 **Gcal/year**, or 3610.2 **thousand tenge/year** with an average weighted tariff for natural gas in 2025 4033.7 tenge/Gcal.

The initial data and results of calculating the efficiency of investments in the replacement of window blocks with energy-saving window blocks for the branch of JSC Kazakhtelecom in the Turkestan region are given in Table 3.36-3.38.

Table 3.36 The initial data for calculating the effectiveness of investments

Investments in the project, thousand tenge	42 016,0
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	4,0
Discount rate (as of 02/14/2025), %	16,50%
Consumer price index (by April 2025), %	10,70%
Corporate income tax, %	20%
Equipment service life, years	5%

* Current retail prices of commercial gas for consumers of QAZAQGAZ AIMAQ JSC from July 1, 2024

Table 3.37 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	-
The volume of reduction in heat consumption, Gcal	0,895	0,895	0,895	0,895	0,895	0,895
Projected cost of gas, thousand tenge/m3	4,03	4,46	4,94	5,47	6,06	4,03
Economic effect of the project implementation, thousand tenge	2,89	3,197	3,539	3,917	4,336	2,89
Free cash flow (FCFE), thousand tenge	-2,888	3,197	3,539	3,917	4,336	-2,888
Accumulated cash flow, thousand tenge	-2,888	0,309	3,848	7,765	12,101	-2,888
Discounted cash flow (Current value-Present Value), thousand tenge	-2,888	2,744	2,607	2,477	2,354	-2,888
Accumulated cash flow, thousand tenge	-2,888	-0,144	2,464	4,941	7,295	-2,888

Table 3.38

Net present value NPV of cash flows, thousands of tenge	19,15
Internal Rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

4) The internal rate of return does not exceed the accepted discount rate;

5) The simple payback period for investments is less than 5 years;

6) The event is appropriate

Result: The expected savings in thermal energy (natural gas) from the introduction of energy-saving measures in the branch of JSC Kazakhtelecom of Atyrau region will approximately amount to 122.5 **Gcal/year**, or **268.9 thousand tenge/year** with an average weighted tariff for natural gas in 2025 of **2195.3** tenge/Gcal. The initial data and results of calculating the efficiency of investments in the replacement of window blocks with energy-saving window blocks for the branch of JSC Kazakhtelecom in Atyrau region are given in Table 3.39-3.41.

Table 3.39 The initial data for calculating the effectiveness of investments by branch

Investments in the project, thousand tenge	6325,2
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	2,2
Discount rate (as of 02/14/2025), %	16,50%
Consumer Price index (by April 2025), %	10,70%
Corporate income tax, %	20%
Equipment service life, years	5

* Current retail prices of commercial gas for consumers of QAZAQGAZ AIMAQ JSC from July 1, 2024

Table 3.40 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	-
The volume of reduction in heat consumption, Gcal	0,122	0,122	0,122	0,122	0,122	0,122
Projected cost of gas, thousand tenge/m3	2,20	2,43	2,69	2,98	3,30	2,20
Economic effect of the project implementation, thousand tenge	0,21	0,237	0,263	0,291	0,322	0,21
Free cash flow (FCFE), thousand tenge	-0,214	0,237	0,263	0,291	0,322	-0,214
Accumulated cash flow, thousand tenge	-0,214	0,023	0,285	0,576	0,898	-0,214
Discounted cash flow (Current value-Present Value), thousand tenge	-0,214	0,204	0,193	0,184	0,175	-0,214

Accumulated cash flow, thousand tenge	-0,214	-0,011	0,183	0,367	0,541	-0,214

Table 3.41

Net present value NPV of cash flows, thousands of tenge	1,42
Internal rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;

2) The simple payback period for investments is less than 5 years;

3) The event is appropriate

Result: The expected savings in thermal energy (natural gas) from the introduction of energy-saving measures in the branch of JSC Kazakhtelecom of the Aktobe region will approximately amount to 130.5 **Gcal/year,** or 313.1 **thousand tenge/year** with an average weighted tariff for natural gas in 2025 of 2399.0 tenge/Gcal. The initial data and results of calculating the efficiency of investments in the event of replacing window blocks with energy-saving window blocks for the branch of JSC Kazakhtelecom in the Aktobe region are given in Table 3.42-3.44

Table 3.42 The initial data for calculating the effectiveness of investments

Investments in the project, thousand tenge	10 465,0
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	2,4
Discount rate (as of 02/14/2025), %	16,50%
Consumer Price index (by April 2025), %	10,70%
Corporate income tax, %	20%
Equipment service life, years	5

** Current retail prices of commercial gas for consumers of QAZAQGAZ AIMAQ JSC from July 1, 2024*

Table 3.43 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	-
The volume of reduction in heat consumption, Gcal	0,13	0,13	0,13	0,13	0,13	0,13
Projected cost of gas, thousand tenge/m3	2,40	2,66	2,94	3,25	3,60	2,40
Economic effect of the project implementation, thousand tenge	0,25	0,276	0,306	0,338	0,375	0,25
Free cash flow (FCFE), thousand tenge	-0,249	0,276	0,306	0,338	0,375	-0,249
Accumulated cash flow, thousand tenge	-0,249	0,027	0,332	0,671	1,046	-0,249
Discounted cash flow (Current value-Present Value), thousand tenge	-0,249	0,237	0,225	0,214	0,203	-0,249
Accumulated cash flow, thousand tenge	-0,249	-0,012	0,213	0,427	0,630	-0,249

Table 3.45

Net present value NPV of cash flows, thousands of tenge	1,65
Internal rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;
2) The simple payback period for investments is less than 5 years;
3) The event is appropriate

Result: The expected savings of thermal energy (natural gas) from the introduction of energy-saving measures in the branch of JSC Kazakhtelecom of Mangystau region will approximately amount to 69.1 **Gcal/year,** or 259.7 **thousand tenge/year** with an average weighted tariff for natural gas in 2025 3758.1 tenge/Gcal. The initial data and results of calculating the efficiency of investments in the replacement of window blocks with energy-saving window blocks for the branch of JSC Kazakhtelecom in Mangystau region are given in Table 3.46-3.48.

Table 3.46 Initial data for calculating the effectiveness of investments

Investments in the project, thousand tenge	1 500,0
Tariff for thermal energy in 2025, thousand tenge/Gcal (natural gas)*	3,8
Discount rate (as of 02/14/2025), %	16,50%
Consumer Price index (by April 2025), %	10,70%
Corporate income tax, %	20
Equipment service life, years	5

Table 3.47 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	-
The volume of reduction in heat consumption, Gcal	0,069	0,069	0,069	0,069	0,069	0,069
Projected cost of gas, thousand tenge/m3	3,80	4,21	4,66	5,15	5,71	3,80
Economic effect of the project implementation, thousand tenge	0,21	0,232	0,257	0,285	0,315	0,21
Free cash flow (FCFE), thousand tenge	-0,210	0,232	0,257	0,285	0,315	-0,210
Accumulated cash flow, thousand tenge	-0,210	0,022	0,279	0,564	0,879	-0,210
Discounted cash flow (Current value-Present Value), thousand tenge	-0,210	0,199	0,189	0,180	0,171	-0,210
Accumulated cash flow, thousand tenge	-0,210	-0,010	0,179	0,359	0,530	-0,210

Table 3.48

Net present value NPV of cash flows, thousand tenge	1,39
Internal Rate of return (IRR), %	121%
Profitability Index (PI)	0,00
Simple payback period (PP), years	2,000
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;
2) The simple payback period for investments is less than 5 years;
3) The event is appropriate

Thus, the total thermal energy savings of JSC Kazakhtelecom are shown in Table 3. 49

Table 3.49

No.	Name of the PB	Q_{mn}, saving thermal energy	Savings, thousand tenge/year	Investments, thousand tenge
1	Almaty region	507,1	2396,8	17 363,0
2	West Kazakhstan region	95,5	253,9	10 764,6
3	Zhambyl region SF	129,0	682,0	2037,0
4	Turkestan region SF	895,0	3610,2	42 016,0
5	Atyrau region SF	122,5	268,9	6325,2
6	Aktobe region SF	130,5	313,1	10 465,0
7	Mangystau region SF	69,1	259,7	1 500,0
	Total:	**1948,7**	**7 784,6**	**90 470,8**

The energy saving potential is:
N = 1948.7 Gcal/year or 278.6 TEF per year

5 Event "Increasing the efficiency of heat transfer from radiators to a heated room by covering the outer wall behind the radiator with a heat-reflecting screen"

Cast-iron radiators are used in the Customer's buildings for space heating. Due to the lack of heat-reflecting screens, the walls behind the radiators are heated, which leads to excessive consumption of thermal energy without benefit for heating buildings.

Heating devices are usually installed at the exterior walls of the room. When the device is running, it actively heats the section of the wall located directly behind it. Thus, the temperature of this area is significantly higher than the rest of the wall area, and can reach 50 °C. Instead of using all the heat to heat the indoor air, the radiator uses the heat to heat the cold panels of the exterior wall of the building. This is the reason for the increased heat loss. To significantly reduce heat losses in this situation, the installation of heat-reflecting screens isolating the wall sections located behind the heating devices allows. The best effect occurs if the distance between the radiator and the wall is 35-55 mm. A typical installation scheme for a heat-reflecting screen is shown in Fig. 3.4.

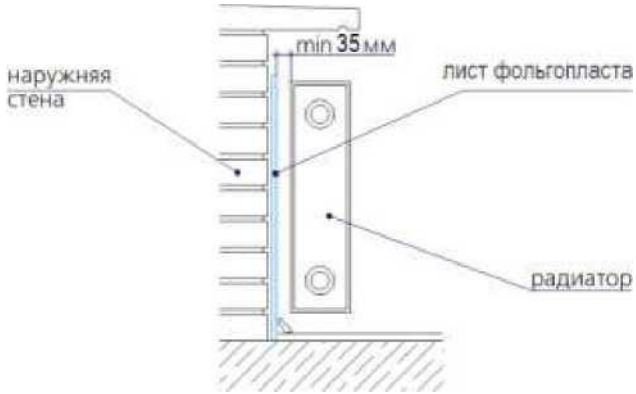

Рис. 3.4

Materials with a low coefficient of thermal conductivity (about 0.05 W/ m^S) are used as such screens, for example, foam foam — a foam base with one-sided foiling or isolan. The heat-reflecting panel made of isolane is a soft rolled material consisting of a heat-insulating layer 5 mm thick, covered on one side with aluminum foil. But in principle, even ordinary foil can serve as a heat-reflecting screen.

General installation recommendations:

- recommended insulation thickness 3-5 mm
- the reflective layer should be facing towards the heat source
- when using reflective insulation without a sticky layer, fastening is performed using a construction stapler or nails through a wooden rail with an interval of 150-200 mm.

The installation of such reflectors (Fig. 3.5) is a low-cost way to save energy with a low payback period. If there is an underfloor heating in the room, the installation of such screens helps to increase the temperature by 3-4 degrees, the efficiency of the heating system increases to 20 %.

Fig. 3.5

The installation of heat-reflecting screens behind radiators at the facilities of JSC Kazakhtelecom will ensure savings in the heating system. Based on the data from the Garden "Methodological recommendations for calculating the effects of implementing energy conservation and energy efficiency measures" of the Analytical Center under the Government of the Russian Federation (August 2016), we accept 5 percent. The total heating costs of the Customer's building and facility are shown in Table 3.50:

Table 3.50

Thermal energy consumption for the 2023 base year		
West Kazakhstan Region SF	Gcal	2593,0
Aktobe region SF	Gcal	2470,1
Atyrau region SF	Gcal	966,5
Mangystau region SF	Gcal	1902,5
Zhambyl region SF	Gcal	1461,4
Turkestan region SF	Gcal	1199,4
Cost is 1 Gcal*	KZT	3852,4

** Weighted average price of natural gas in Kazakhstan*

The amount of necessary thermal insulation material is accepted taking into account the installed radiators, 3 m2 of material will be needed for 1 radiator. The calculation of the costs of installing heat-reflecting screens is given in Table 3.51..

Table 3.51

Name of the material	**The price of thermal insulation material per 1 m2, including VAT tenge**	**The amount of thermally insulating material, m2**	**Total cost of equipment including VAT, tenge**
Foiled penofol 5 mm	433	2155	933,1
Total investments			933,1

The total cost of investments is 933.1 tenge

The energy saving potential is:

N = 10592.9 Gcal/year * 0.05 = 529.6 Gcal/year or 76.5 TEF per year

In monetary terms, the annual savings from energy-saving measures are:

E = 529.6 Gcal/year * 3.8 thousand tenge/ Gcal= 2012.6 thousand tenge/year

Based on the calculations made, the mandatory implementation of this measure is recommended, since the payback and economic effect of this measure are positive.

The initial data and the results of calculating the effectiveness of investments in the event are given in Table 3.52-3.54.

Table 3.52 The initial data for calculating the effectiveness of investments

Investments for the installation of heat-reflecting screens, thousand tenge	933,1
Tariff for thermal energy in the base (2025) year, thousand tenge/Gcal (natural gas)	3,8
Discount rate (as of 02/14/2025), %	16,5%
Consumer price index (by April 2025), %	10,7%
Corporate income tax, %	20%
Equipment service life, years	20

Table 3.53 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	365	366	365	365
Operating year number	-	1	2	3	4	5
The amount of reduction in thermal energy consumption, Gcal	0,529	0,529	0,529	0,529	0,529	0,529
The projected cost of thermal energy, thousand tenge/Gcal	3,80	4,21	4,66	5,15	5,71	3,80
Economic effect of the project implementation, thousand tenge	1,61	1,780	1,971	2,182	2,415	1,61
Free cash flow (FCFE), thousand tenge	-1,608	1,780	1,971	2,182	2,415	-1,608
Accumulated cash flow, thousand tenge	-1,608	0,172	2,143	4,324	6,739	-1,608
Discounted cash flow (Current value- Present Value), thousand tenge	-1,608	1,528	1,452	1,380	1,311	-1,608
Accumulated cash flow, thousand tenge	-1,60816	-0,080	1,372	2,752	4,063	-1,60816

Table 3.54 The results of the calculation of investment efficiency

Net present value NPV of cash flows, thousand tenge	10,67
Internal rate of return (IRR), %	121%
Profitability Index (PI)	0,01
Simple payback period (PP), years	2,0
Discounted payback period (DPP), years	3

Conclusions:

1) The internal rate of return exceeds the accepted discount rate by two or more times;
2) The payback period for investments is less than 5 years;
3) The event is appropriate.

6 Event "Adjustment of fittings and replacement of seals on window structures"

According to Appendix No. 3 - analysis of the thermal imaging survey of the external enclosing structures of the building, the temperature on the slopes of a number of translucent structures and doors is below the dew point (CH RK 2.04-04-2011 5.7). The presence of a temperature significantly lower than the normalized temperature means that moisture will form in these places, mold and fungi will appear, contributing to the development of pathogenic microbes and viruses. The nature of the detected defects indicates a loose fit of the sealing rubber bands and loose joints due to the influence of climatic factors on the metal parts of the fittings.

Description of the event. We recommend adjusting the fittings and replacing the seals with translucent structures. You can buy ready-made seals that attach to the outside of the double frame. They consist of a fixed mounting profile (wood, light metal or plastic) and a sealing lip that fits snugly against the window sash, and the stronger the wind blows outside, the tighter it fits. Calculation of thermal energy savings when replacing the window seal: Building height: N, m;

Height from ground level to the top of windows: h, m;

Estimated room temperature: Tc °C

Average outdoor temperature during the heating period: тот°C

The area of window openings: F m2

Reduced heat transfer resistance of translucent structures: R = m2 OS/W

Duration of the heating period, duration of the day, hours.

Calculation:

1. Pressure difference between indoor and outdoor air

$$\Delta p = 3463 \cdot (\mathrm{H} - h) \cdot \frac{t_н^p - t_н}{(\mathrm{t}_н^p + 273) \cdot (\mathrm{t}_н + 273)}$$

2. The amount of outside air infiltrating the room through the windows

$$G_{инф} = \frac{F_{ok} \cdot \Delta p_{огр}^{0,667}}{3600 \cdot R_{ок}}$$

3. Saving the heat needed to heat the infiltrating air:

$$Q = G_{инф} (\mathrm{t}_в^p - t_н) \cdot N \cdot 0,86 \cdot 10^{-3}$$

Substituting the values of the variables into the formulas, we get:

Q = 221,35 Gcal or 31.65 TEF

At the current gas tariff of 3852.4 tenge/Gcal will result in estimated cash savings of 431.65 thousand tenge per year.

The initial data and the results of calculating the efficiency of investments in the event of adjusting fittings and replacing seals on window structures are given in Table 3.55-3.57.

Table 3.55 The initial data for calculating the effectiveness of investments

Capital investments for modernization, thousand tenge	2937,76
Cost of thermal energy in 2025, tenge/Gcal	3,8
Discount rate (as of 02/14/2025), %	16,5%
Consumer Price Index (April 2025), %	10,7%
Corporate income tax	20%
Equipment service life, years	20

Table 3.56 Production performance and cash flow from investments

Beginning of the forecast period	01.01.2026	01.01.2027	01.01.2028	01.01.2029	01.01.2030	01.01.2031
End of the forecast period	31.12.2026	31.12.2027	31.12.2028	31.12.2029	31.12.2030	31.12.2031
Calendar year/quarter	2026	2027	2028	2029	2030	2031
Number of days in the period	365	365	366	365	365	365
Operating year number	0,00	221,35	221,35	221,35	221,35	221,35
The volume of reduction in fuel consumption, Gcal	1,95	2,07	2,19	2,32	2,46	2,61
Projected cost of fuel oil, tenge/Gcal	2937,76	402,63	426,79	452,40	479,54	508,31
Economic effect of the project implementation, thousand tenge	-2937,76	402,63	426,79	452,40	479,54	508,31
Free cash flow (FCFE), thousand tenge	-2937,76	-2535,13	-2108,34	-1655,94	-1176,40	-668,09
Accumulated cash flow, thousand tenge	-2937,76	369,39	359,22	349,33	339,72	330,37
Discounted cash flow (Current value - Present Value), thousand tenge	-2937,76	-2568,37	-2209,15	-1859,82	-1520,10	-1189,73
Accumulated cash flow, thousand tenge	0,00	221,35	221,35	221,35	221,35	221,35

Table 3.57 Results of investment efficiency calculation

Net present value NPV of cash flows, thousands of tenge	-1189,73
Internal rate of return (IRR), %	-8%
Profitability Index (PI)	-0,40
Simple payback period (PP), years	8
Discounted payback period (DPP), years	10

Conclusions:

1) The internal rate of return does not exceed the accepted discount rate;

2) The payback period for investments is 8 years;

3) The event is appropriate.

1.2 DRAFT ACTION PLAN FOR ENERGY CONSERVATION AND ENERGY EFFICIENCY IMPROVEMENT

The draft "Action Plan for Energy conservation and energy efficiency improvement of JSC Kazakhtelecom for 2026-2031" (hereinafter – the Plan) was developed in accordance with the Order of the Minister of Investment and Development of the Republic of Kazakhstan dated March 31, 2015 No. 391 "On approval of the requirements for the form and content of the action plan for energy conservation and energy efficiency improvement, developed by the State Entity the Energy Register based on the results of the energy audit" and is given in Table 3.25 - 3.27.

By 01.04.2026, JSC Kazakhtelecom , in accordance with paragraph 2 of article 9 of the Law of the Republic of Kazakhstan "On Energy Conservation and Energy Efficiency Improvement", is obliged to approve and send a Plan developed on the basis of the budget and prospects for the development of the organization until 2031 to the Operator of the state energy registry.

If it is necessary to adjust the Plan, according to clause 4 of the "Requirements for the form and content of the energy conservation and energy efficiency action plan developed by the subject of the State Energy Register based on the results of the energy audit", JSC Kazakhtelecom has the right to make Additions and (or) changes to the Plan, having approved them by the first head, indicating the deadline for both approval and and his re-approval.

Draft action plan for energy saving and enhancement of JSC Kazakhtelecom for 2026-2030

Table 3.58

Code and number	Events	Implementation period	Planned expenses, million tenge					The volume of planned reduction in energy consumption, TEF					Mark of completion
			2026	2027	2028	2029	2030	2026	2027	2028	2029	2030	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy saving zone: Power supply and lighting													
EiOs.01	Replacement of fixtures and lamps with LED	from 01.26 to 12.26	0,00	7,74	0,00	0,00	0,00	0,00	0,00	17,1	17,1	17,1	
Total:			**0,00**	**7,74**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**17,1**	**17,1**	**17,1**	
In total:			**7,74**					**17,1**					
Energy saving zone: Heat supply and heating													
Tiot.01	Adjusting fittings and replacing seals on window structures	from 01.21 to 12.21	0,00	2,9	0,00	0,00	0,00	0,00	0,00	31,65	31,65	31,65	
TiOt.02	Covering the outer wall behind the radiator with a heat-reflecting screen	from 01.21 to 12.21	0,00	0,93	0,00	0,00	0,00	0,00	0,00	76,5	76,5	76,5	
TiOt.03	Replacement of window blocks (profiles) with new energy-saving ones	from 01.21 to 12.21	0,00	90,5	0,00	0,00	0,00	0,00	0,00	278,6	278,6	278,6	
Total:			**0,00**	**94,3**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**386,75**	**386,75**	**386,75**	
In total:			**94,3**					**386,75**					
Total according to plan			**0,00**	**102,0**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**403,85**	**403,85**	**403,85**	
In total according to plan			**102,0**					**403,85**					

Table 3.59

Code and number	Events	Implementation period	Planned expenses, million tenge					Planned savings, million tng.					Payback period
			2026	2027	2028	2029	2030	2026	2027	2028	2029	2030	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Energy saving zone: Power supply and lighting													
EiOs.03	Replacement of fixtures and lamps with LED	from 01.26 to 12.26	0,00	7,74	0,00	0,00	0,00	0,00	0,00	3,9	3,9	3,9	5
Total:			**0,00**	7,74	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**3,9**	**3,9**	**3,9**	
In total:			**7,74**					**3,9**					
Energy saving zone: Heat supply and heating													
Tiot.01	Adjusting fittings and replacing seals on window structures	from 01.26 to 12.26	0,00	2,9	0,00	0,00	0,00	0,00	0,00	0,43	0,43	0,43	8
TiOt.02	Covering the outer wall behind the radiator with a heat-reflecting screen	from 01.26 to 12.26	0,00	0,93	0,00	0,00	0,00	0,00	0,00	2,0	2,0	2,0	2
TiOt.03	Replacement of window blocks (profiles) with new energy-saving ones	from 01.26 to 12.26	0,00	90,5	0,00	0,00	0,00	0,00	0,00	7,7	7,7	7,7	>10
Total:			**0,00**	**94,3**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**10,1**	**10,1**	**10,1**	
In total:			**94,3**					**10,1**					
Total according to plan			**0,00**	**102,0**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**14,0**	**14,0**	**14,0**	
In total according to plan			**102,0**					**14,0**					

Table 3.60

Code and number	Name of the energy resource	The volume of planned reduction in energy consumption (TEF)					Planned savings, million tenge					Possible reduction of maximum power	Potential to reduce energy consumption (%)	Mark of completion
		2026	2027	2028	2029	2030	2026	2027	2028	2029	2030			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EE.04	Electric power	0,00	0,00	17,1	17,1	17,1	0,00	0,00	3,9	3,9	3,9	-	0,034	-
TE.05	Thermal energy (incl. boiler and furnace	0,00	0,00	386,75	386,75	386,75	0,00	0,00	10,1	10,1	10,1	-	0,77	-
	Total:	**0,00**	**0,00**	**403,85**	**403,85**	**403,85**	**0,00**	**0,00**	**14,0**	**14,0**	**14,0**	**-**	0,81	**-**

Table 3.61

Code and number	Naming of the specific indicator	The unit of measurement of the organization's energy efficiency coefficients used	The amount of planned reduction in energy consumption per unit of production/area				
			2026	2027	2028	2029	2030
1	2	3	4	5	6	7	8
TE.05	Thermal energy (incl. boiler and furnace fuel)	TEF/m2	0,141	0,141	0,140	0,140	0,140

2. CONCLUSIONS

"Energy on track" LLP, based on the results of the energy audit of JSC Kazakhtelecom facilities, the following Conclusions were made:

1. The main energy consumption by JSC KAZAKHTELECOM facilities accounts for 167 buildings, which were mainly built in the middle of the last century and have wear of up to 60%. Most of the buildings have energy efficiency class "D" and "E". The main reason for the low value of specific heat consumption for heating is that a significant part of the buildings and structures that are on the balance sheet of JSC KAZAKHTELECOM were built during the 80s and 90s of the twentieth century. Also, some buildings lack glazing, which reduces the thermal efficiency of the building. Accordingly, most of the buildings are mentally and physically worn out and require major repairs with elements of thermal modernization. The level of energy efficiency of buildings is low, it is recommended to carry out measures for thermal protection of buildings and structures.

2. The main share of consumption is accounted for by electric energy and amounted to 43% (21117 TEF) of total fuel and energy complex consumption in the base year 2023.

- thermal energy - 8.6% (18426.7 TEF),
- gasoline - 11% (5350 TEF)

3. Commercial metering devices for electric energy, thermal energy and water are partially equipped with remote data transmission modules and verified. The verification dates correspond to the established verification interval.

4. The drainage and sewerage system is also in good technical condition.

5. The lighting systems are dominated by LED lamps and LED panel lamps. However, incandescent lamps, fluorescent lamps, and AML lamps are present in remote areas of JSC Kazakhtelecom branches. The automatic lighting control system is functioning.

6. The heating points of the buildings of JSC Kazakhtelecom , which are connected to the CST, have elevator heating units that do not allow effective control of the building's heat consumption.

7. Most internal heating systems lack regulating and balancing devices.

8. A significant part of the irrational heat losses through the enclosing structures of JSC Kazakhtelecom buildings can be eliminated during their regular maintenance, without significant costs.

2.1 ENERGY SAVING POTENTIAL

The energy audit report was prepared in accordance with the Energy Audit Rules approved by the Order of the Minister of Investment and Development of the Republic of Kazakhstan No. 400 dated 31.03.2015.

Based on the results of the energy audit of JSC Kazakhtelecom facilities and the analysis of the information received, a draft action plan for energy conservation and energy efficiency improvement has been developed. A feasibility study on energy conservation and energy efficiency improvement has been prepared for each event.

According to the Draft Plan, 3 economically feasible measures are recommended for implementation.

The energy saving potential based on the results of the recommended measures is shown in Table 3.60.

The final energy saving potential is 403.85 TEF or 0.81% of energy consumption in the base year 2023.

The implementation of energy saving and energy efficiency measures by JSC Kazakhtelecom will require economically feasible investments in the amount of 196.04 million tenge.

2.2 ASSESSMENT OF ENERGY SAVING AND ENERGY EFFICIENCY IMPROVEMENT ACTIVITIES

The energy audit of JSC Kazakhtelecom facilities is being conducted for the first time. The staff carries out a set of administrative actions aimed at ensuring the rational consumption of energy resources. Technical accounting of electric energy consumption has been organized, consumption is monitored and operational measures are being taken based on the results of consumption analysis.

The results of the evaluation of activities of JSC Kazakhtelecom in the field of energy conservation and energy efficiency improvement are given in Table 3.62.

Table 3.62

No.	Evaluation criteria	Description of the existing state	Performance assessment, (excellent/good, satisfactory, absent)
1.	Implementation of an energy management system in accordance with the requirements of the standard ISO 50 001	Available	Satisfactory
2.	The presence of an approved action plan in the field of energy conservation and energy efficiency improvement, or an energy saving program developed by the company on a voluntary basis prior to the energy audit.	Available	Good
3.	Assessment of the implementation of the action plan in the field of energy conservation and energy efficiency improvement.	Available	excellent
4.	Equipment with metering and control devices, availability of an automated energy consumption accounting system	equipped partially	satisfactorily
5.	Availability of a system of financial and non-financial incentives for the implementation of energy efficiency measures.	absent	absent

In order to organize systematic work to reduce energy costs, it is recommended to improve the energy management system in accordance with the requirements of the ST RK ISO 50 001 standard and introduce the position of energy manager to monitor the consumption of energy resources and the implementation of energy-saving measures.

LIST OF REGULATORY DOCUMENTS USED

1. The Law of the Republic of Kazakhstan dated January 13, 2012 No. 541-IV "On Energy conservation and energy efficiency improvement".

2. Rules for conducting an energy audit, approved by Order of the Minister of Investment and Development of the Republic of Kazakhstan dated 31.03.2015 No. 400.

3. Requirements for energy efficiency of buildings, structures, structures and their elements that are part of enclosing structures, approved by Order of the Minister of Investment and Development of the Republic of Kazakhstan dated March 31, 2015 No. 406.

4. Requirements for the form and content of the action plan for energy conservation and energy efficiency improvement, developed by the subject of the State Energy Register based on the results of the energy audit, approved by the Order of the Minister of Investment and Development of the Republic of Kazakhstan dated 31.03.2015 № 391.

5. "Instructions for scanning, energy audit and energy monitoring in buildings." Approved by the Order of the Chairman of the State Institution "Agency of the Republic of Kazakhstan for Construction and Housing and Communal Services" dated December 29, 2010 No. 606.

6. SN RK 2.04-21-2004. Energy consumption and thermal protection of civil buildings.

7. SN RK 2.04-04-2011. Thermal protection of buildings.

8. SN RK 4.04-23-2004. Electrical equipment of residential and public buildings. Design standards.

9. SNiP RK 2.04-01-2010 Construction climatology.

10. SNiP RK 2.04-03-2002 . Construction heat engineering.

11. SNiP 31-06-2009. Public buildings and structures.

12. SNiP RK 2.04-05-2002 . Natural and artificial lighting.

13. SNiP RK 4.02-42-2006 Heating, ventilation and air conditioning.

14. GOST 30494-96. Residential and public buildings. Indoor climate parameters.

15. GOST 31168-2003. "Residential buildings. A method for determining the specific consumption of thermal energy for heating".

16. GOST 26629-85. "Buildings and structures. The method of thermal imaging quality control of thermal insulation of enclosing structures".

17. GOST R 54983-2012. Gas distribution systems. Natural gas distribution networks. General requirements for operation. Operational documentation.

18. WD 153-39.4-079-01. A methodology for determining gas costs for the technological needs of gas enterprises and losses in gas distribution systems.

19. Order No. 47 of the Federal Environmental, Technological and Nuclear Supervision Service dated February 6, 2017 "On Approval of the Safety Manual "Instructions for Technical Diagnostics of Underground Steel Gas Pipelines".

20. STO Gazprom gas distribution 2.8-2013. Methodology for calculating the effectiveness of energy-saving and innovative measures in the development and implementation of programs of Gazprom Gazoraspredenie, St. Petersburg: Gazprom Gazoraspredenie, 2013. 131 p. (СТО Газпром газораспределение 2.8-2013. Методика расчета эффективности энергосберегающих и инновационных мероприятий при разработке и реализации программ ОАО «Газпром газораспределение». СПб.: ОАО «Газпром газораспределение», 2013. 131 с.)

21. Khvorov G.A., Kozlov S.I., Akopova G.S., Evstifeev A.A. Reduction of natural gas losses during transportation via Gazprom mainline pipelines. 2013. No. 12. pp. 66-69. (Хворов Г.А., Козлов С.И., Акопова Г.С., Евстифеев А.А. Сокращение потерь природного газа при транспортировке по магистральным газопроводам ОАО «Газпром» // Газовая промышленность. 2013. № 12. С. 66-69.)

22. Pavlovsky M.A. Application of mathematical statistics methods to analyze the causes of the imbalance of natural gas transport in the pipeline gas transmission system // Electronic scientific journal "Oil and Gas business". 2012. No. 1. pp. 69-75. (Павловский М.А. Применение методов математической статистики для анализа причин дисбаланса транспорта природного газа в трубопроводной газотранспортной системе // Электронный научный журнал «Нефтегазовое дело». 2012. № 1. С. 69-75.)

23. Ignatiyev A.A. Assessment of the cause of the imbalance of gas volumes in the "supplier - consumer" system // Gas Industry. 2010. No. 6. pp. 20-22. (Игнатьев А.А. Оценка причины разбаланса объемов газа в системе «поставщик - потребитель» // Газовая промышленность. 2010. № 6. С. 20-22.)

24. Tukhbatullin F.G., Semeychenkov D.S. On the causes of natural gas imbalance in the gas distribution system and methods for predicting its magnitude // The territory of NEFTEGAZ. 2017. No. 6. pp. 14-21. (Тухбатуллин Ф.Г., Семейченков Д.С. О причинах разбаланса природного газа в системе газораспределения и методах прогнозирования его величины // Территория «НЕФТЕГАЗ». 2017. № 6. С. 14-21.)

25. Salikov A.R. Imbalance in gas distribution networks // Russian gas. 2015. No. 4. pp. 36-41. (Саликов А.Р. Разбаланс в сетях газораспределения // Газ России. 2015. № 4. С. 36-41.)