

Research and development work

The main directions of technological development of KEGOC JSC are:

- Innovation;
- R&D;
- Innovation and inventive activities (IIA).

Indicators of technological development of KEGOC JSC over the last 5 years

	2019	2020	2021	2022	2023
Total costs, KZT million, including for:	399.58	1,887.43	236.97	3.72	15.09
- Innovations	382.08	1,834.97	215.50	-	-
- R&D	15.79	45.14	19.80	-	-
- Innovation activities	1.71	7.32	1.67	3.72	15.09
The number of employees engaged in research activities, people	26	26	26	26	26

Total costs of KEGOC JSC for technological development in 2023

15.09 KZT million

Innovations

ACCORDING TO THE GLOBAL TREND, WORK CONTINUES IN THE FIELD OF MODERN INNOVATIVE AND DIGITAL TECHNOLOGIES, THE BASIS OF WHICH IS THE INTRODUCTION OF VARIOUS ELEMENTS OF INTELLIGENT MANAGEMENT OF NETWORK FACILITIES (MEASUREMENT, MONITORING, CONTROL AND MANAGEMENT SYSTEMS), ON THE BASIS OF WHICH A NEW GENERATION OF ELECTRIC NETWORKS, THE SO-CALLED ‘SMART GRID’, CAN BE CREATED.

The construction of an intelligent energy system (Smart Grid) affects all participants in the electric power industry: generation, transmission, distribution, supply, consumption and system operation.

Smart Grid assumes the ability to control the behavior of all its participants in real time in order to ensure sustainable, cost-effective, safe power supply and improve the quality of services provided, their accessibility and implies obtaining technical and economic benefits from the integration of all participants in the energy network, which ensures a high level of reliability and safety.

The main directions of Smart Grid in the Republic of Kazakhstan, extended to the sectors of generation, transmission and distribution, sales and consumption of electricity, are:



Monitoring

includes a set of technologies that ensure the collection and processing of information in real time to monitor the operating modes of the electric power system and the condition of its assets.



Power system management

includes a set of technologies that affect control facilities in real time in order to ensure the normal operation of the electric power system.



Accounting

includes a set of technologies aimed at measuring quantities in real time, used for appropriate settlements between entities.



Asset management

includes a set of technologies aimed at maximizing the efficient use of electrical installations throughout their life cycles and making management decisions regarding electrical installations.



Data management

includes a set of technologies aimed at integrating information systems, displaying information about current and forecast data in real time in general and by subject and territorial affiliation.

KEGOC JSC is actively implementing Smart Grid technologies to improve the reliability and efficiency of the UPS of the Republic of Kazakhstan. Currently, projects are under implementation to modernize the SCADA/EMS system and expand the WAMS monitoring system (stage 2), which will improve the efficiency of dispatching control and the observability of the modes of operation of the UPS of the Republic of Kazakhstan, as well as ensure monitoring of stability reserves and assessment of the state of the UPS of the Republic of Kazakhstan as a whole.

In 2023, the implementation of the Pilot Project 'Introduction of electric power storage systems in the UPS of the Republic of Kazakhstan' (Pilot project) was launched to study the impact of electric power storage systems on the regulation of the UPS during the integration of renewable energy sources. On December 4, 2023, an Agreement was signed between KEGOC JSC, China Power International Development Limited, China Power International Holding Limited and the Association of Renewable Energy of Kazakhstan for the implementation of this Pilot Project.

Following the results of the Pilot Project, with the support of the Association of Renewable Energy of Kazakhstan, recommendations will be developed on amendments to regulatory legal acts of the Republic of Kazakhstan and the development of regulatory and technical documentation on the use of electricity storage systems in the UPS of the Republic of Kazakhstan.

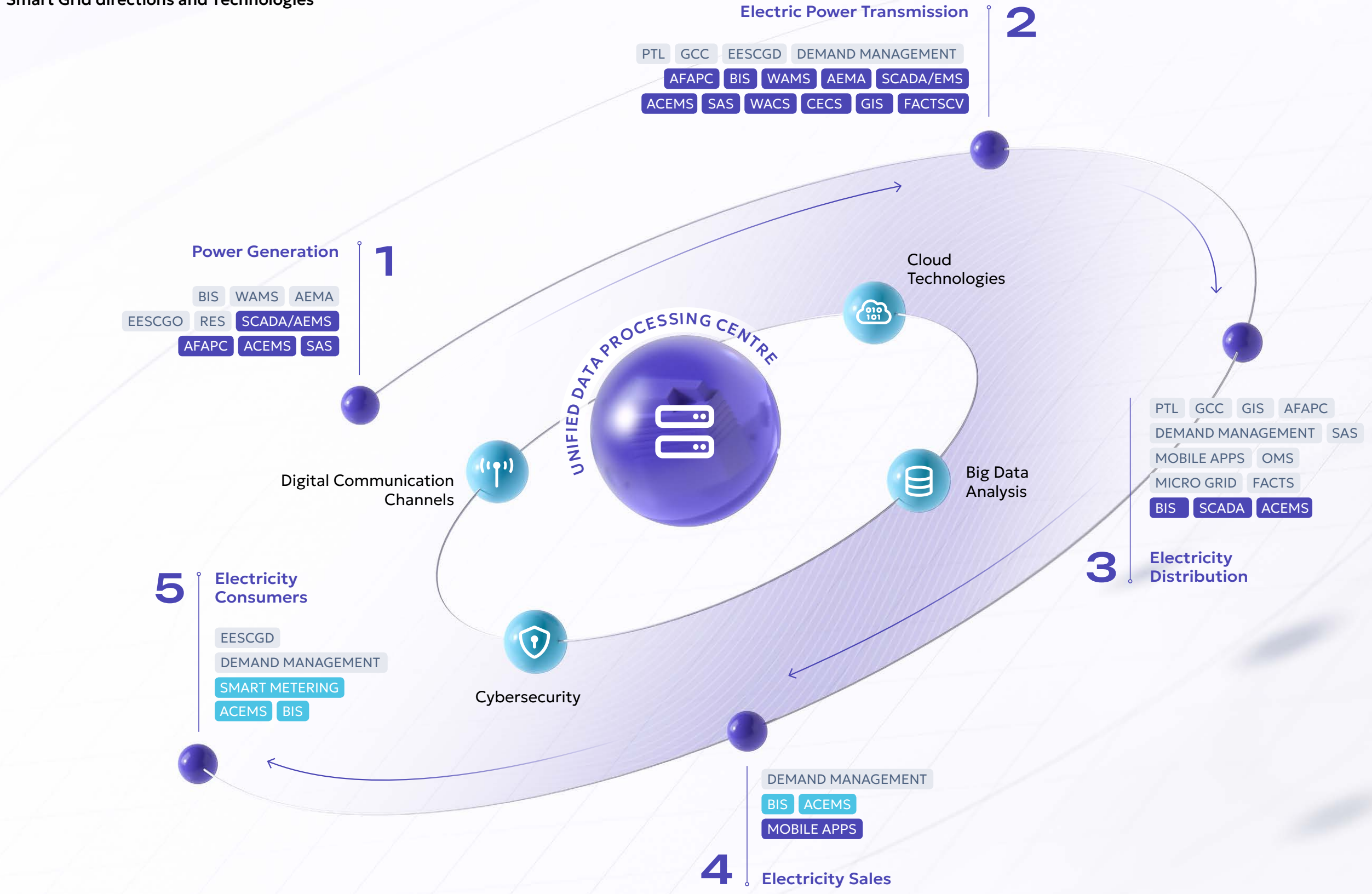
The implementation of the Pilot project will stimulate the development of electricity storage technologies in the Republic of Kazakhstan, which in turn will ensure an increase in the number of renewable energy sources in the country.

According to the Pilot project, it is planned to install an electric power storage system at a 500 kV substation 'City step-down substation' with a capacity of

6.77 MWh



Smart Grid directions and Technologies



● Promising ● Implemented ● Completed

Research and development work

The Company's R&D management activities are regulated by relevant internal documents that establish uniform requirements for the organization, planning, accounting, control of execution and acceptance of R&D performed by order of KEGOC JSC. R&D is considered as a process that covers the entire life cycle from defining tasks to evaluating and taking into account the actual effect of using the results of development in the practical activities of the Company.

R&D in the Company is aimed at achieving the strategic goals of the Company in accordance with the Development Plan of KEGOC JSC and the Innovation and Technology Policy of KEGOC JSC.

The main goals in the organization of R&D in the Company are:

- creation, systematization and development of R&D planning and execution processes, taking into account their priority and relevance for the innovative and technological development of the Company;
- ensuring effective interaction of processes related to the development and use of scientific and technical products;
- implementation of R&D results to improve the efficiency and quality of production and business processes;
- monitoring the achievement of targets.



Implemented projects of feasibility studies (FS), research and development work (R&D)

R&D 'Assessment of the technical condition of shunting reactors and autotransformers of KEGOC JSC for planning their maintenance, repair and reconstruction'

Years of implementation: **2003**

FS for reactive power compensation in the 220-500 kV grid of the UPS of the Republic of Kazakhstan in order to stabilize voltage, increase throughput and reduce losses

Years of implementation: **2008**

R&D 'Development of design documentation for the anchor assembly for fastening the guy ropes of intermediate supports such as ISF-1150-1, ISF-1150-5, ISF-1150-11 with removal to the surface of the earth'

Years of implementation: **2011**

FS for the creation of a system for automatic frequency control and power overflows of the UPS of the Republic of Kazakhstan

Years of implementation: **2012**

R&D 'Study of the effectiveness of automatic control of the transmission capacity of 220-500-1150 kV transmission lines of the NPG of the Republic of Kazakhstan with the development of control algorithms to ensure stability'

Years of implementation: **2012-2013**

R&D 'Study of electromagnetic transients on 220 kV buses of 500 kV Shymkent substation at the installation of a 200 MW BSC'

Years of implementation: **2015**

FS to reduce electricity losses at Korona in the NPG of the Republic of Kazakhstan

Years of implementation: **2015-2018**

R&D on reducing electricity losses in 500 kV transmission lines with OPGW

Years of implementation: **2017-2020**

R&D 'Study of the effectiveness of ARV settings of system power plants to ensure static and dynamic stability of 500-220 kV NPG of the Republic of Kazakhstan'

Years of implementation: **2018-2022**

FS on the development of algorithms and creation of WACS automation based on synchrophasor measurements of WAMS

Years of implementation: **2019-2020**

Research to determine the factors and source of contamination of insulation of electrical equipment 'Zapadnye MES'

Years of implementation: **2021**

FS on the possibility of using energy storage devices for the UPS of the Republic of Kazakhstan

Years of implementation: **2021**

FS on digital substations technologies

Years of implementation: **2021**

FS for the selection of FACTS devices for reactive power compensation in the UPS of the Republic of Kazakhstan

Years of implementation: **2021-2022**

Ongoing FS and R&D projects

FS to ensure reliable operation of the UPS of the Republic of Kazakhstan in conditions of isolated operation from adjacent power systems

Years of implementation: **2023-2024**

FS of the need to ground the shielding shells of control cables on a substations with microprocessor-based RPA devices

Years of implementation: **2023-2024**

Patenting the results of the work

R&D ‘Development of design documentation for the anchor assembly for fastening the guy ropes of intermediate supports such as ISF-1150-1, ISF-1150-5, ISF-1150-11 with removal to the surface of the earth.’

Based on the results of the work, innovative patent No. 27514 was obtained, registered in the State Register of Inventions, Utility Models, Industrial Designs, Trademarks, appellations of Origin of Goods, breeding achievements of the Republic of Kazakhstan.

Benefits: this innovation has made it possible to reduce the cost of conducting an audit of the anchor assembly of the support ties, carried out with the opening of the ground during operational work. The innovation was implemented on the 1150 kV Ekibastuz – Kokshetau, Kokshetau – Kostanay, Kostanay – Chelyabinsk and Ekibastuz – Altai overhead lines.

1

FS to reduce electricity losses at Korona in the NPG of the Republic of Kazakhstan.’

Based on the results of the work, the following patents were obtained for inventions registered in the State Register of Inventions, Utility Models, Industrial Designs, trademarks, names of places of origin of goods, selection achievements of the Republic of Kazakhstan:

- No. 32955 ‘Electrolytic arc installation’;
- No. 34167 ‘Anti-corona coating, the method of its creation and the electrolytic solution used in the method’.

Benefits: these inventions make it possible to reduce losses on the ‘crown’ on overhead line wires in the rain.

2



Innovation and inventive activities

The IIA in KEGOC JSC is aimed at achieving the Company’s strategic goals in accordance with the KEGOC JSC Development Plan and the KEGOC JSC Innovation and Technology Policy.

The organization of the IIA is carried out in accordance with the ‘Rules for the organization of innovation and inventive activities in KEGOC JSC and its subsidiary.’

The main advantage of IIA is the opportunity for each employee to participate in this process, which in turn allows you to minimize the time from birth to the implementation of an idea and cover the maximum number of employees of the Company.

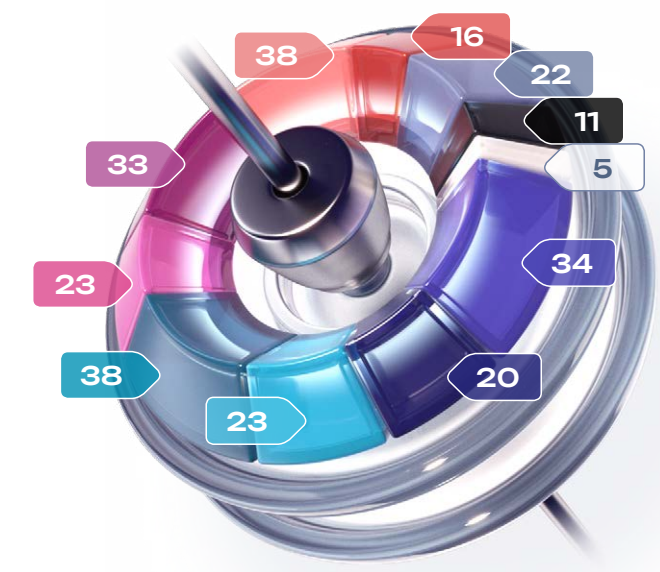
Within the framework of the IIA, ideas are identified with the possibility of being applied in other divisions of the Company and conditions are provided for scaling the offer.

The main objectives of the IIA organization are:

- activation of IIA and further development of mass technical creativity of the Company’s and Subsidiaries’ employees.
- increasing the interest of the Company’s employees in the results of their work through moral and material incentives.

In 2023, 23 applications were recognized as innovative and rewards for innovative proposals in the amount of KZT 15 million were paid. The maximum amount of remuneration of KZT 10 million was paid in 2023 for the implementation of the rationalization proposal ‘Improving the reliability of power supply of the Kostanay power plant’ to the branch of KEGOC JSC Sarbaiskiye MES. As part of this innovation proposal, a technical solution has been developed to reduce transit through third-party networks. The economic effect of the implementation of this innovation proposal is KZT 68 million per year.

Registered innovation proposals in KEGOC JSC for the period 2013-2023



- Executive Directorate and Energoinform JSC
- Akmolinskiye MES
- Aktyubinskiye MES
- Almatinskiye MES
- Vostochnye MES
- Zapadnye MES
- Severnye MES
- Sarbaiskiye MES
- Tsentralnye MES
- Yuzhnye MES
- NDC SO

During the period 2013-2023 in KEGOC JSC were registered **262** innovation proposals