

CENTURY-OLD TRADITIONS - STATE-OF-THE-ART TECHNOLOGIES



IZOLYATOR

Company established in 1896

#3/2019 (22) July – September, 2019



Opening of
Izolyator
Classroom at MPEI



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Leaders of Power Industry

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In recent years, the Russian Federation and the Kingdom of Saudi Arabia (KSA) have been actively developing bilateral cooperation. Strengthening partnerships of the largest oil-producing states contributes to the resolution of controversial issues in the field of world energy pricing and provides political, infrastructural and social prospects for the development of the region. At the same time, Saudi Arabia is interested in cooperation with Russia not only in the oil and gas sector, but also in the electric power industry, in particular in the localization of Russian technologies on its territory.

Izolyator's entrance into the electrical market of the Kingdom is one of the important steps towards the development of relations between the countries. In April 2019, Saudi Electricity Company (SEC) included the Izolyator plant in the list of official high voltage bushings suppliers for transformer plants in Saudi Arabia.

Large and serious work related to the search for professional consultants who understand all the nuances of doing business in the country had been done shortly before this event. Based on the consultants'

recommendations, an effective strategy for entering the market was developed. One of the elements of the strategy was communication establishment and close cooperation between Isolator and the Saudi Arabian General Investment Authority (SAGIA — the Kingdom state structure assisting foreign companies in promoting their technologies and innovations into the country's economy).

Using the high assessment of Izolyator's production and technological potential received from SAGIA representatives during their visit to the plant in January 2018, Izolyator started to implement the strategy and launched a program for the Saudi Arabia market promotion.

Alexander Zinovievich Slavin-sky, Chief Executive Officer of Zavod 'Izolyator' LLC told more

New Business Partners are result of long-term strategy

Alexander SLAVINSKY,
Eng.D.,
Chief Executive Officer of Zavod
'Izolyator' LLC,
Head of Russian study
committee D1 RNC CIGRE



about the development of cooperation with Saudi Arabia in an interview with the observer of «ELECTRIC POWER. Transmission and distribution» journal.

— Alexander Zinovievich, how did you manage to enter the Kingdom's electrical market and what arguments were critical for the Saudi partners when deciding on cooperation with your company?

— Izolyator plant has won the trust of partners in many countries worldwide, constantly confirming its high status as a leader in the production of high-voltage bushings, including bushings with solid RIP- and RIN- insulation. At the same time, we are continuously working to strengthen relations with electric grid and generating companies, as well as with transformer plants around the world. The consistent quality, professional competence and our comprehensive service support has provided partners' confidence.

We regularly conduct a thorough analysis of the main trends in the international power industry market in order to find strategic partners for planning effective and long-term cooperation. An important factor in the development of international relations is an active participation of Russia in the International Council on Large Electric Systems (CIGRE).

Leading positions impose great responsibility on our company. We emphasize that we are ready to share the unique accumulated experience with all our partners. We consider it as an integral part of our mission — to create the foundations for a stable and sustainable energy supply worldwide.

I believe that all these factors influenced on our colleagues from Saudi Arabia when deciding on cooperation with us.

— What products of Izolyator plant will be delivered to Saudi Arabia? What is the expected volume of delivery?

— We plan to supply bushings for the Kingdom's energy facilities for all main voltage classes up to and including 380 kV. At the moment, we study market, requirements, specifics of work and organize so-called «comparison with competitors» program. It is difficult to assess the volume of deliveries now, but the prospects are significant, since Saudi Arabia's economy is being developed very actively and large-scale

investment development programs in power generation and distribution are adopted. The «Saudi Vision 2030» program is underway. In the future, we expect to occupy a significant market share not only in KSA, but also in other countries of the region.

— Are there any special conditions for a new company to enter the Saudi Arabian market? What is the readiness of the Izolyator plant to meet these conditions?

— The Saudi Arabia's market is quite mature, very competitive and saturated. All major western and eastern players have been working on it for many years, their stable business connections and supply chains have developed. Thus, it is very difficult to enter the market without «superior expectation» of a value proposition for a new player. No one expects new suppliers. However, new opportunities are always offered for those who seek. The Saudi Vision 2030 transformation program, adopted in the Kingdom in 2016 became such an opportunity for us. The main goal of the program is to move on KSA's economy from oil dependence and to create modern local industries in the country, including electric power industry. Since we already have successful experience in localizing production abroad and taking into account the recommendations of our consultants, we seriously considered the possibility of entering the KSA market. As of today, we are currently making significant progress in this matter. Taking into account all the factors, I would like to note that the entry into the Saudi Arabian market will be successful only for mature companies characterized by high production culture, advanced technologies and processes, a stable financial situation and commitment to success. Underdogs and companies planning to «make money fast» are not expected in the country.

— Taking into account the ambitious plans of Izolyator, it is safe to say that the partnership with Saudi Arabia will not be limited by the supply of high-voltage bushings to this country. What promising areas of development do you plan to discover?

— Of course, you can burn all potential profit for 10 years in advance and fail in participating in price wars with world grandees for a market share. We are trying to distance ourselves from this path. Our choice is localization and obtaining a competitive advantage due to this. Taking into account all the preferences provided by the Government of the country for foreign investors and the absence of local bushings producers on the KSA market, we have a unique chance to avoid heavy market fights and to enter the market not only of Saudi Arabia, but also of other countries,

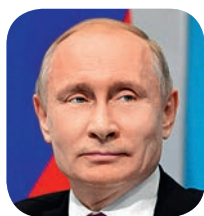


Visit of Saudi Power Transformers Company plant in Saudi Arabia

being a part of Cooperation Council for the Arab States of the Gulf. The dialogue with international energy corporations continues to develop. Russian energy companies lend active support in this direction. Due to the established work with such large companies as PJSC «Rosseti», including Rosseti FGC UES, we managed to accumulate unique experience in the massive use of high voltage bushings with solid RIP insulation. Our main task today is to convince a larger number of partners worldwide that we fully possess the necessary competences for sharing our experience.

Entering the Saudi Arabian electrical market is an important stage in the development of bilateral relations between our countries. It will help to increase Russian non-oil exports, as well as the recognition and development of «Made in Russia» brand.

On this occasion, on behalf of Izolyator plant, I would like to invite all developers and manufacturers of electrical equipment to promote products jointly and to participate in the development of long-term cooperation with business partners in Saudi Arabia!



«The backlog we created with the new capacities gives us today the opportunity to implement a large-scale long-term program of Russian Power Industry modernization».

Vladimir Putin
President of Russian Federation

Vladimir Putin called on investors to invest in the Far East



Vladimir Putin at the plenary meeting of the V Eastern Economic Forum in Vladivostok. Left: Indian Prime Minister Narendra Modi, right: Mongolian President Khaltmaagiin Battulga

Over 8.5 thousand people from 65 countries took part in the V Eastern Economic Forum. Of the foreign delegations, Japan had the most representatives - 588 people, followed by China with 395, South Korea with 285 in third, followed by India with 204. Altogether 440 companies participated. At the EEV-2019, 270 agreements were signed in the amount of more than 3.4 trillion rubles.

Russian President Vladimir Putin called on investors to actively invest in the Far East, giving strong emphasis on unique business conditions. The growth of industrial production in the Far East over five years amounted to almost 23% - three times higher than country average. ■

XXIV World Energy Congress

The delegation of the Rosseti Group of Companies, headed by Pavel Livinskiy, General Director, participates in the XXIV World Energy Congress taking place in Abu Dhabi this year.

On the final day of the forum, which is considered the leading platform for the development of the international energy dialogue, Pavel Livinskiy took part in a session on global priorities for electric grid complex development "Innovations in Networks: Simulation of Power Grid of the Future".

The session participants noted the following key challenges: development of distributed generation and renewable energy sources, creation of high-power accumulators, and growing demands of users who turn from consumers into prosumers, that is, basically become electricity suppliers along with electricity producers.

Pavel Livinskiy spoke about the company's plans to introduce additional services that enable to develop digital technologies. "We aim to be a multi-platform company that, remaining its core competence in reliable and high-quality power supply, will be able to offer its pre-



XXIV World Energy Congress participants

sent and future customers such additional services as energy management, creating technological conditions for prosumer distribution, analysis of consumption pro-

files, development of electricity storage and network reserve services, multimedia service provider and many more," said Pavel Livinskiy. ■

Experts discussed Electricity Distribution sector future



V All-Russian Scientific and Technical Conference 'Development and Improving the Reliability of Operating Electricity Distribution Networks'. On stage — Deputy General Director - Chief Engineer of the Rosseti Group of Companies Andrey Mayorov

Izolyator took part in the Fifth All-Russian Scientific and Technical Conference 'Development and Improving the Reliability of Operating Electricity Distribution Networks', which was held in Moscow and became an on-site session of the Power Grids International Forum (PGIF 2019). The conference was organized by the Rosseti Group of Companies, and co-organized by the Moscow United Energy Company. Business program partner is the magazine 'Electric power. Transmission and distribution'.

In addition to the executives and specialists of Rosseti, the participants of the on-site session were the heads of large regional electric grid companies: the Yugorsk Regional Electric Grid Company, the Moscow United Energy Company, the Moscow Regional Energy Grid Company,

Oboronenergo, the Kazan Grid Company and others. The event was also attended by experts from oil and gas companies, scientists from the Russian Academy of Sciences and Universities. Izolyator was represented by Chief Executive Officer of Zavod 'Izolyator' LLC, Doctor of Technical Sciences Alexander Slavinsky. In total, more than 300 participants attended the conference.

At the conference they discussed topical issues of implementing the concept of digital transformation of the electric grid complex, the development of distribution electrical networks, practical aspects of the operation of electrical networks, including the organization of live work in distribution networks.

The results of the conference will form the basis of the PGIF 2019 technical program. ■

Results of Conference 'Energy Industry through the eyes of youth 2019'

Izolyator took part in the 10th Anniversary International Scientific and Technical Conference 'Energy Industry through the eyes of youth 2019' in Irkutsk, which was attended by 300 young specialists from 20 energy companies of Russia; students, graduate students and young scientists of 25 Russian and foreign universities.

Organizers of the 10th Anniversary Conference: Irkutsk National Research Technical University, System operator of the Unified Energy System, Russian National Committee of the International Council for Large High



Vladimir Ustinov with the participants of the 10th Anniversary International Scientific and Technical Conference 'Energy Industry through the eyes of youth 2019', Irkutsk

Voltage Electric Systems (RNC CIGRE), Federal Grid Company of the Unified Energy System, Charity fund of educational incentives 'Bright generation'.

Representatives of the Izolyator plant took part in the conference as experts of section No. 2 'Operating modes and equipment of electric networks and systems'. The section was moderated by Izolyator Deputy Quality Director, coordinator of the CIGRE National Study Committee D1 'Materials and Emerging Test Techniques' RNC CIGRE (NSC D1 RNC CIGRE) Vladimir Ustinov.

The members of the expert commission named the best reports in the nominations: the best report (awarded with the prize of the Izolyator plant); the best poster presentation of the student, the best poster presentation of the young specialist; the best sectional report of the student, the best sectional report of the young specialist; the best report with the most complex and laborious solution to a scientific problem. As part of a round table with the participation of students and energy companies' representatives, Vladimir Ustinov made a presentation of both Izolyator and NSC D1 RNC CIGRE activities. ■

MPEI Celebrated the Knowledge Day



Wishes of passion for knowledge to the students of MPEI

Chief Executive Officer of Zavod 'Izolyator' LLC Alexander Slavinsky took part in gala ceremony at the Moscow Power Engineering Institute on the occasion of the start of new academic year.

During the Knowledge Day MPEI Rector Nikolay Rogalev, Deputy General Director - Chief Engineer at Rosseti Andrey Mayorov and other guests representing power generating

and industrial electrical engineering companies pronounced their addresses to students.

In his speech, Alexander Slavinsky wished the students passion for knowledge and accomplishment of all their goals.

As a part of celebration an opening ceremony of Izolyator plant's classroom was held. ■

8 | Opening of Izolyator Plant's Classroom at MPEI



MPEI's rector Nikolay Rogalev, Deputy Minister of Energy Yury Manevich and Alexander Slavinsky, CEO at Zavod Izolyator LLC cut the symbolic red ribbon during opening of Izolyator Plant's Classroom at MPEI

"The auditorium created by the Izolyator plant will help students gain fundamental knowledge and skills for further work in electric grid and electrical companies. We are contributing to the development of the material and technical base for training future specialists in the field of energy. Such a foundation makes it possible to solve the ambitious tasks facing the industry and to cope with new challenges".

Ivan Panfilov, Commercial Director, First Deputy CEO, graduate of MPEI 2001. Institute of Electrical Engineering.



"It was very pleasant, after almost 10 years from the moment of graduation, to return to the walls of my Alma Mater and to see with my own eyes all the changes that happened during this time. I hope that the new classroom will help to convey to future electric power specialists the connection between the theory of electrical processes and the practical application of this knowledge for the benefit of Russian Energy Industry"

Dmitry Lopatin, Technical Director of Izolyator-AKS, graduate of MPEI 2010. Department of Engineering Management



"While studying at the institute, sometimes I didn't understand why I should study this or that subject, and only after starting work at the Izolyator plant I was repeatedly convinced of the need for the information that was given at MPEI. That is, only when starting to engage in specialized professional activities, I was able to truly appreciate the depth and volume of knowledge provided at the Moscow Power Engineering Institute".

Pavel Kiryukhin, Deputy Chief Designer. Graduate MPEI 2005.
Dept. of Electrical and Electronic Apparatuses, Institute of Electrical Engineering

"The opening of the Izolyator specialized auditorium is a continuation of our comprehensive interaction and we hope that it will contribute to a comfortable, high-tech process of student education and the involvement of qualified university graduates in our company."

Sergey Moiseev, General Director of Massa LLC, graduate of the Moscow Power Engineering Institute in 2014, graduate student since 2018, Dept. On management in power engineering and industry at Engineering-Economic Institute



"Thanks to the Moscow Power Engineering Institute for such a useful and interesting experience. I am grateful to the institute for the acquired applied knowledge in various fields of electrical engineering and the electric power industry"

Stanislav Nikitin, Graduate MPEI 2018, Dept. of Physics and Technologies of Electrical Materials and Components at Institute of Electrical Engineering



«The modern power complex is one of the key prerequisites of the economic and social development».

Dmitry Medvedev
Chairman of the Government of the Russian Federation

All-Russian Congress of Power Industry Professionals

In Chelyabinsk Traktor Sports Palace there was held the first and biggest meeting of line and senior managers and experts representing Russian power grid companies - All-Russian Congress of Power Industry Professionals. 102 winners in the first contest for the power grid sector, Power Industry Leaders, were announced.

An event of this scale and scope is being held in Russia for the first time - more than 2000 power industry professionals from all over the country attended the meeting. During a month, over 1,800 heads of power grid districts and similar business units from all-over Russia demonstrated their theoretical knowledge and practical skills by performing different assignments online and on site. Remote evaluation efforts, technical audit of 38 power grid districts in the Chelyabinsk Region and solution of cases in the core lines of the modern power industry development were conducted.

The agenda of the forum included a discussion of priority areas for the development of the industry related to the modernization and digital transformation of the electric grid infrastructure.

A keynote speech was made by the Director General of Rosseti, Pavel Livinsky, in the framework of which he outlined the priority directions for the development of the holding, and also presented a report on the transition of subsidiaries of Rosseti to a single brand.

As part of the work of the All-Russian Congress, Izolyator introduced innova-

tive electrical products. Chief Executive Officer at Izolyator Plant LLC Alexander Slavinsky introduced Pavel Livinsky, Director General of Rosseti Group, and Andrei Mayorov, Deputy General Director and Chief Engineer of Rosseti Group, new developments of high voltage bushings with RIN (RIS) insulation. This equipment has been certified by the Rosseti Group and is already in operation at its power facilities.

As part of the forum, Izolyator plant employees, Alexander Savinov, director of strategic sales, and Alexey Pilyugin, lead chief engineer at SVN-Service, held a number of business meetings with partners - representatives of electric grid companies.

On the last day of the Congress, the final stage of the All-Russian Power Industry Leaders contest was held, following which the names of the most motivated and professional employees who will



Participants of the All-Russian Congress of Power Industry Leaders in Chelyabinsk



«Participants in the competition are without exaggeration, the intellect and hands of the systemic reliability of the entire electric grid complex in Russia».

**Pavel Livinsky,
Director General of Rosseti**

be included in the personnel reserve of the Russian electric grid complex were announced.

Welcome speech to the contest participants was sent by Dmitry Medvedev. The Prime-Minister's message told: «The modern power industry system is one of the main prerequisites of the economic and social development. The industry faces new, large scale, objectives now. And these objectives cannot be addressed without you, talented, ambitious, focused people we pin great hopes on. Yet, it is your unconventional, bright thinking that enables to implement the boldest and the most advanced ideas. I am sure you will be able to show special managerial qualities, not only deep knowledge».

The winners were chosen by a professional jury, which included the heads of the Ministry of Energy of Russia and the companies of the Rosseti group, laureates of 'Leaders of Russia' management contest. The expert group from PJSC FGC UES was headed by Andrey Murov, Chairman of the Management Board of the company.

"Participants in the competition - heads of Rosseti regional lines and similar units in other companies - are without exaggeration, the intellect and hands of the systemic reliability of the entire electric grid complex in Russia. When deciding to launch the Power Industry Leaders contest, we wanted, first of all, to highlight how important this category of managers is for the industry", - emphasized Pavel Livinsky, Director General of Rosseti. As

the head of the holding, speaking at the opening he stated: «there are no losers in this contest, participation in the final is a great chance to prove oneself, and also this is a great opportunity for the heads



«The industry is changing very quickly by the impact of advanced technologies, and I am pleased that Rosseti invests in development of the personnel competencies, in addition to digitalization of the grid infrastructure».

**Alexander Novak,
Russian Energy Minister**

of enterprises present here today to see what their employees are capable of", - said Pavel Livinsky.

Mr. Alexander Novak, Russian Energy Minister and Chairman of Rosseti Board of Directors, who spoke at the closing ceremony, welcomed similar events and emphasized their special significance for the entire country. «It is well known that the power industry is the foundation of the modern economy. The industry is changing very quickly by the impact of advanced technologies, and I am pleased

that Rosseti invests in development of the personnel competencies, in addition to digitalization of the grid infrastructure. I would like to congratulate all participants in the Power Industry Leaders contest and, of course, the winners. I am sure you will make a significant contribution to strengthening and happy future of Russia!»

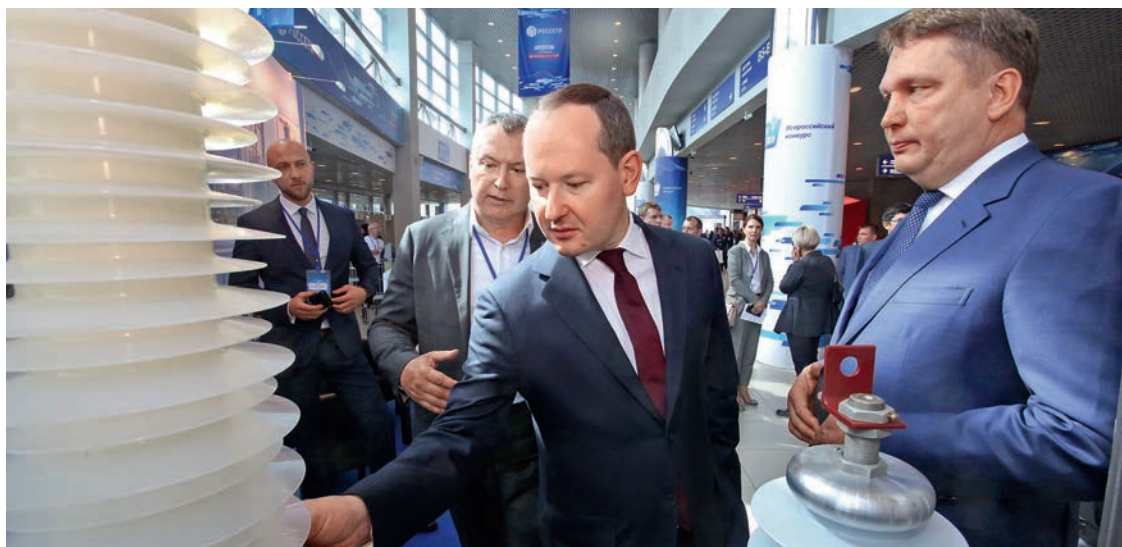
Mr. Alexey Texler, acting Governor of the Chelyabinsk Region, noted the significance of holding the first congress of the power industry professionals and executives in that particular venue for the region. «Our region has a well-diversified power system, with its own generation and grids. But you should never stop developing, in particular, in the age when the technologies changing the world rapidly are spreading. We will continue to develop the region's grid infrastructure and to consolidate the power grid assets on the basis of

12 | In focus: All-Russian Congress of Power Industry Professionals



Visits to the exponents – partners of Rosseti Group, L-R: Alexey Texler, acting Governor of the Chelyabinsk Region, Alexander Novak, Russian Energy Minister, Pavel Livinskiy, Rosseti CEO

Acquaintance with the innovative products of Izolyator plant, foreground-left: Alexander Slavinsky, Director General of the Rosseti Group Pavel Livinsky and Deputy General Director – Chief Engineer of the Rosseti Group Andrei Mayorov

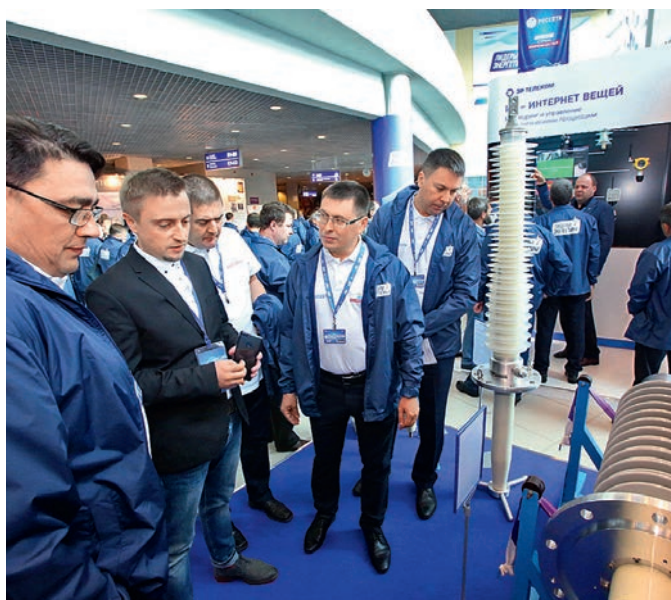


Always happy to meet business partners



◀ New ideas - new paths to cooperation

▶ Izolyator booth always draws attention



▲ New technologies of Izolyator arouse great professional interest

▼ Representatives of the Izolyator plant working at the company booth, L-R: Lead Commissioning Engineer Aleksey Pilyugin, PR&Marcom specialist Ksenia Boricheva and Director of Strategic Sales Alexander Savinov



Anniversary International Science Conference on diagnostics of electrical equipment

International Applied Science Conference 'Production, operation, diagnostics and maintenance of high-voltage bushings and measuring transformers. Requirements to transformer oil for high-voltage equipment' and 25th anniversary plenary meeting of the Public Council of Specialists in power electrical equipment diagnostics by Engineering Technical Center 'UralEnergEngineering' were held in Moscow.



Alexander Slavinsky is pronouncing an opening address to the participants of the 25th Applied Science Conference on diagnostics of power equipment

The Conference is organized by the Public Council of Specialists in power electrical equipment diagnostics by Engineering Technical Center 'UralEnergEngineering' jointly with Izolyator plant, Public Council of Specialists in diagnostics of electrical units of Siberia and Far East with support from the CIGRE National Study Committee D1 'Materials and Emerging Test Techniques'.

This year, the Izolyator plant provided venue for the event and not only set the stage for discussion, but also conducted tour of manufacturing facilities, familiarizing the guests with the entire production process cycle: from manufacturing parts of high-voltage bushings to the work of test center equipped with the most modern tools and diagnostic stands allowing

testing products in full accordance with the requirements of Russian and international standards.

The conference was attended by 112 participants (6 doctors of sciences and 11 candidates of technical sciences) including representatives of Sweden, the Republic of Uzbekistan, and the People's Republic of China.

Welcoming words to the conference participants were addressed by the Chairman of the Public Council of Specialists in power electrical equipment diagnostics by ETC 'UralEnergEngineering' Alexey Utepov and Chief Executive Officer of Zavod Izolyator LLC, Head of CIGRE National Study Committee D1, Member of the Public Council of Specialists in power electrical equipment diagnostics by ETC 'UralEnergEngineering' Alexander Slavinsky. Conference participants discussed issues of production, operation, diagnostics and maintenance of measuring transformers, high-voltage bushings, reports on the requirements for operation, storage and recovery of the of transformer oil and electrical equipment renovation. During the discussion, directions for improving regulatory documents in the digitalization of the electric power industry were proposed.



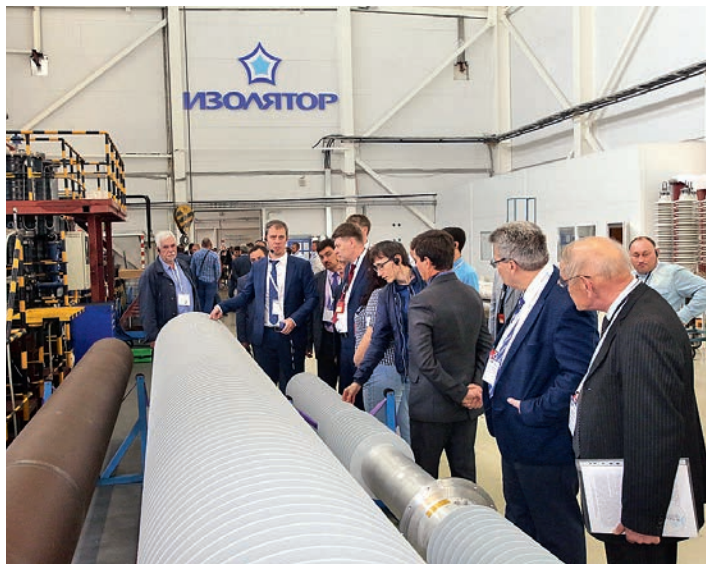
The 25th Applied Science Conference on diagnostics of power equipment, Moscow

25th Anniversary
Conference

112 Participants
including

6 Doctors
of Science

11 PhDs
in Engineering



Participants in the 25th Anniversary International Applied Science Conference on diagnostics of high-voltage equipment familiarize themselves with the production of high-voltage bushings at the Izolyator plant



The conference agenda includes reports on Izolyator's innovative technologies

The great interest of energy companies in discussing the problems of operation and diagnostics of high-voltage bushings and transformers is confirmed by the level of conference participants, among them:

1st Deputy Chairman of Regional Electric Networks of the Ministry of Energy of the Republic of Uzbekistan Ruzikul Rayimov, Advisor to the Director General of PJSC ROSSETI Evgeny Mishuk, Deputy Chief Engineer of PJSC FGC UES Alexander Ter-skov, Director for Scientific and Technical Support of JSC "UES Technical Inspection" Leonid Daryan.

The conference was attended by Russian manufacturers of electrical products, diagnostic equipment and transformer oil: Izolyator plant, Ramensky Electro-technical Plant 'Energy', SVEL Group, INCAB LLC, Elmash (UETM) LLC, LLK- International LLC, Rosneft-Lubricants, LLC Polyephir, LLC Dimrus, LLC NPO Logotech, JSC Pergam-Engineering, NTBE LLC R&D company.

Representatives of power grid companies, generating and scientific organizations such as PJSC ROSSETI, Bashkir Distribution Electric Grids, FGC UES, Moscow Power Engineering Institute, Ural Federal University, Novosibirsk State Technical University, Kazan State Electric University, Kazan National University of Economics, Ivanovo State Electric University all noted the introduction of new types of equipment and diagnostic equipment (bushings with internal RIN insulation, gas-insulated

measuring transformers, anti-resonant voltage transformers, ultrasonic flaw detectors), efficiency of use for diagnostics vibroacoustic and spectral methods. For 25 years, the Public Council of Specialists in power electrical equipment di-

preparation for signing of the Agreement of Cooperation between the Public Council of Specialists in power electrical equipment diagnostics by ETC UralEnerggoEngineering LLC and Russian National Committee of the International Council



The visiting session of the 25th Anniversary International Applied Science Conference on diagnostics of high-voltage equipment at the Izolyator Plant was Successfully Completed

agnostics by ETC UralEnerggoEngineering LLC has been a powerful communication center providing interaction between manufacturing plants, operating, repair, service and diagnostic organizations, as well as research institutes and universities.

The visiting session of the 25th Anniversary International Applied Science Conference on diagnostics of high-voltage equipment at the Izolyator Plant was Successfully Completed In framework of

for Large High Voltage Electric Systems (RNC CIGRE), Olga Frolova, Executive Director of RNC CIGRE, took part in the conference.

Following the results of the conference, Izolyator plant and ETC UralEnerggoEngineering LLC will prepare a series of reports for release and sent them to the voting members of the Diagnostic Council together with the 2019 newsletter and the anniversary collection of selected works of the Council.

16 | Key Trends of High-Voltage Substations Development Based on The Materials of CIGRE Session in 2018

The International Council On Large Electric Systems (Conseil International des Grands Reseaux Electriques - CIGRE) is a permanent non-government non-commercial organization, established in France in 1921. The key objective of CIGRE is development of technical knowledge and information sharing between countries as regards generation and transmission of high-voltage electric power.

The biannual CIGRE sessions are the most comprehensive and prominent in the world forum for high-voltage power network specialists and therefore provide for an opportunity to have an adequate outlook of the modern condition of the global technological complex of generation, transformation, transmission and distribution of electricity. CIGRE's activities embrace virtually all aspects of development of the complex and include:

- high-voltage electrical equipment of HPP, CHPP, distributed generation;
- aerial power lines, cable and gas-insulated power lines;
- high-voltage substations and high-voltage equipment thereof;
- development of electric energy transmission systems and interconnection of power networks;
- problems of electric energy market;

- units and systems of relay protection, automation, telemetry, communications, monitoring and metering of electricity.

Analyzing the last several CIGRE sessions, we can formulate several trends of high-voltage substations development (Fig.1). Creation of smart grids is a vector of strategic development according to CIGRE materials.

Historically, the core functionality of substations is distribution and transformation of electric energy, however, with the development of substations their functions are expanding.

Much is required from the modern substation today: be it a high quality power supply in electric network and at consumers' locations, high reliability of supply with all security and environment protection requirements met, or an excellent controllability. There are

new requirement emerging in regard to some substations to ensure an organic connection distributed generation, an ability to redistribute the power output in to the mains in time.

To realize that function the general requirements, such as cost, energy efficiency, energy saving, compact size, ability to operate at high loads have to be taken into account.

The creation of smart substations is an indispensable element of the Smart grid.

The creation of the smart grid is modernization of the complex system of generation and transportation of electric energy involving improvement of control, protection, optimization of all technological elements in the power system in their interrelationship (from the centralized and distributed generation, the system of electric power transmission, its distribution, automation systems and electricity storage to end users, their electric installations, vehicles, domestic appliances).

This trend of electric networks development is largely connected with a sharp increase of wind and solar generation share in the world power industry, the gradual abandoning of fossil fuel and other fuels that make a strong impact on the atmosphere, despite the need to balance out volatility of renewable sources generation.

The smart grid should be characterized by a two-way flow of electric energy and information. It ensures the transition to a system of distributed calculations and communications for delivery of information in the real-time mode and calculation of an momental balance of demand and supply of electricity in any point. The key technological tools for creating a smart grid are:

- communications on the basis of modern automated systems, primarily digital ones;
- databases using big data technologies;
- automated systems of unauthorized access prevention to the power grid control;

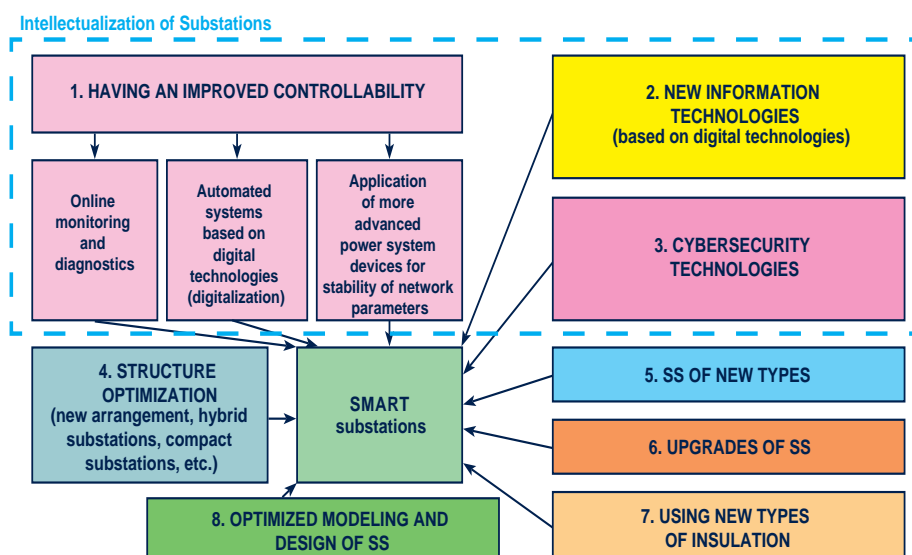


Fig. 1 The key trends of high-voltage substations development

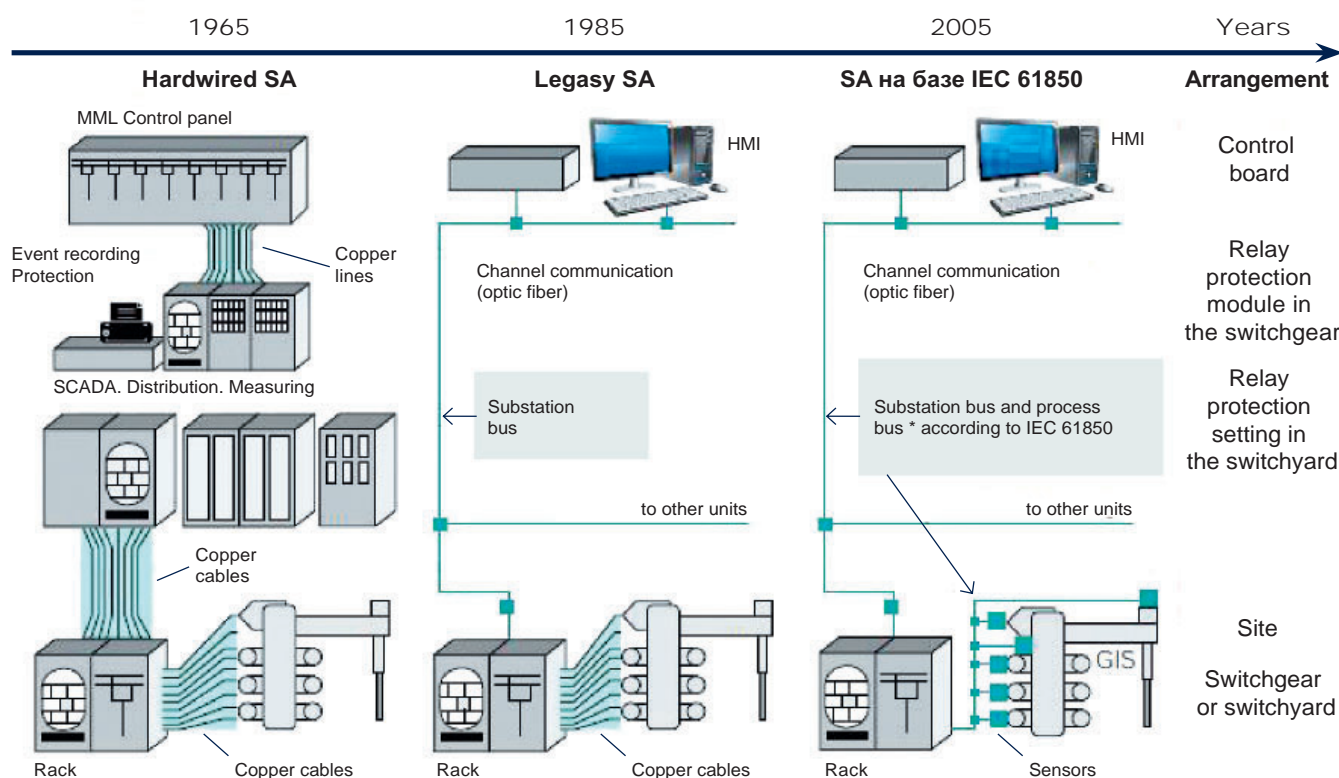


Fig.2 Development of control systems, protection and automation of high-voltage substations [3]

- intelligent power electrical equipment;
- hardware and software, adapted applications in the single information space.

The topics of reports about high-voltage substations, presented at the CIGRE 2018 session only proved the above described trends (Fig. 2).

Presently, the role of digitalization in SMART substations creation is not to be underestimated - the process is implemented in many aspects (automatic control systems, protection and monitoring, diagnostics, general information systems, databases, cybersecurity systems) that prevent from unauthorized access to power grids control. The ways of the economic organization of the whole world economy are in transition to the digital platform.

The digital economy is a type of business activity that uses digital data as its key productive factor. They help to form a deep and dynamic uniform information space of the society in a real-time mode. The power industry is a part of that activity. Digitalization lies in the foundation of the intellectualization of substations (Fig. 1). The base element of digital systems is intelligent electronic devices (IED) - multifunctional devices. They are primarily used as processors and as digital sensors of information and automation equipment as well. IEDs collect data and later perform calculations to fulfil the logic of the

chosen algorithm. The important point is that in addition to the current values, these devices record information about the object's conditions, parameters and history in time.

All of this constitutes the «intellect» of IEDs, which they demonstrate in operation of the power systems' equipment. The modern protocols and communication channels used in IED and communication devices and meeting the IEC 61850 standard allow for the digital information integration. Notably, the intellectualization of electrical networks (as application of the newest information technologies for controlling, protecting and monitoring the equipment and systems of improved controllability of energy systems) is one of the most important but not an exclusive trend of power systems development in the XXI century.

Three levels of intellectualization of electrical systems can be observed: the top one is the intellectualization of the power system in general as a whole megasystem, the medium one is the intellectualization of equipment sets (e.g. power plants or substations) and, finally, the intellectualization of separate types of power equipment and electrical receivers of consumers (smart buildings, streets, etc.).

The new level of control in the intelligent equipment means using micro-processors, controllers, remote terminal units, intelligent electronic devices, new

protocols of information exchange.

The most important feature of intelligent equipment and complexes is a possibility to operate the control, protection and monitoring systems not only vertically - via top-level control system, but also horizontally - via connection with other equipment.

Monitoring and diagnostics of the equipment's key parameters online helps to make a transition from preventive maintenance to repairing on the need, dramatically increasing the efficiency of its application and operational reliability, with an ultimate target of managing the lifecycle of substations' equipment.

The equipment lifecycle management has a direct relation to the economic objectives of power grid companies - efficient management of assets. Thus, our analysis of the materials of reports, presented at CIGRE-2018, demonstrates the trends in development of high-voltage substations of the recent years that have taken shape.

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*Based on the materials of the article,
published in the ELECTRIC ENERGY.
Transmission and Distribution Magazine
#4(55) 2019*

Izolyator bushings with internal RIN insulation are approved by Rosseti Group

On July 3, 2019, the certifying commission of Rosseti Group issued letters of compliance of the Izolyator bushings with internal RIN insulation with technical requirements of Rosseti for use at facilities of subsidiaries and affiliates. Bushings for transformers with the highest operating voltage up to 550 kV, switches with the highest operating voltage from 40.5 to 252 kV and wall bushings with the highest operating voltage from 73 to 252 kV are certified.

The most modern type of internal insulation for high voltage bushings is solid RIP insulation. In our country, bushings with RIP insulation have been successfully used in electrical networks for more than 15 years. These products are highly demanded by the largest electricity companies, both in Europe and Asia. However, practice has shown that even this insulation has got some issues. The major one is the risk of moisture during long-term storage due to the presence of paper in the insulation. In this regard, in 2008 we began working to create a new technology that would allow us to exclude paper from the bushing design, consequently increasing the resistance of the product to moisture and thereby significantly reducing the requirements for storage conditions of bushings. A new technology using non-woven synthetic material, which replaced crepe paper, was called RIN - Resin Impregnated Nonwoven. This innovative component in every sense allows the creation of new generation high-voltage bushings.

RIN insulation manufacturing technology is almost identical to RIP-technology, however, the properties of the material that does not absorb atmospheric moisture eliminate the long, laborious and energy-intensive operation of thermal vacuum drying. The resulting material is not hygroscopic, which makes the dielectric loss factor of the material absolutely stable and independent of exposure to very high humidity. This ensures ease of transportation, absence of special storage requirements, as well as more reliable operation. In addition, the impregnation process that does not leave voids due to the good impregnation of synthetic materials with compounds and the absence of internal voids in synthetic filaments, unlike paper fibers, can be used to obtain a monolithic composite RIN insulation structure, which ensures the absence of partial discharges inside the insulation up to the maximum operating voltage. I'd also like to note that RIN insulation



Konstantin SIPILKIN,
R&D Director
at Izolyator

has a high thermal conductivity and a low coefficient of thermal expansion, which leads to a decrease in voltage between mechanically connected bushing elements. This is important for operation at extreme temperatures, both high and low.

Comprehensive research work was carried out to check and confirm validity of a new type of insulation. In total, more than 100 high-voltage bushings of various types and voltage classes from 35 to 550 kV were manufactured for testing. First of all, we conducted our own tests, which confirmed moist-resistance of RIN insulation.

In addition, all samples of RIN-insulated bushings also passed standard acceptance tests in accordance with GOST R 55187 and IEC 137 (IEC 60317: 2017). Some samples were subject to lengthy endurance tests, as well as thermal stability tests and nominal

current tests. Taking into account the fact that the bushings are operated in different countries, in territories with all kinds of climate conditions, climatic tests as well as earthquake tests were carried out to confirm the presence of the necessary crack resistance and sufficient plasticity of the RIN insulation material. Studies have shown that RIN insulation does have high resistance to moisture and great prospects for use as internal insulation of high-voltage bushings. In particular, the properties of RIN insulation offer opportunities for creating equipment using the superconductivity effect.

The bushings with RIN insulation are characterized by a very low coefficient of dielectric loss $\tan \delta$ 0.20-0.25%, which is significantly lower than the requirements specified in the standards for high-voltage bushings IEC 60137: 2017 and GOST R 55187-2012 with 0.7% benchmark.

As of today, RIN-insulated bushings have passed the whole range of necessary tests, the corresponding certification, and are already undergoing trial operation at Russian Power Facilities.

By now, our new products arouse great interest, which allows Izolyator to outline long-term plans for bushings with RIN insulation development. Currently, the certification procedure for bushings with RIN insulation at PJSC Rosseti has been completed. And already this year we plan to start mass production of bushings in accordance with the High-voltage bushings Roadmap until 2025, developed by the Power Electrical Engineering working group of the Interagency Coordinating Council for the development of power engineering, electrical and cable industries.



Assembly of RIN-insulated bushings for oil circuit breakers



500, 330 and 220 kV RIN bushings placed on technological racks at the assembly shop of Izolyator Company



Installation of a 252 kV bushing with RIN-insulation on a 40 MVA transformer at the 220 kV Dalnyaya substation in the Vladimir region

20 | Transformation of Electric Power Systems

In June 2019, the XXIX applied science conference on the topic 'State and future outlooks for the power industry and high-voltage electrical equipment. Transformers. Switching devices. Converters. Control and diagnostic systems', organized by TRAVEK International Association of Manufacturers of High-Voltage Electrical Equipment took place. The article discusses the ongoing processes of transformation of electric power systems in the world, which lead to radical changes in the global energy sector, and the challenges facing the Russian electric power industry in these conditions.

Currently, the electric power industry in many countries of the world is undergoing significant changes. The factors stimulating these changes are associated with environmental restrictions, digitalization and automation of electric power systems (EPS), a significant reduction in the cost of renewable energy technologies, the development of distributed generation, increased requirements for the reliability and efficiency of EPS, the development of electrification of the economy, etc.

The ongoing technological changes are accompanied by the creation of an institutional framework that defines the regulatory, technological, economic rules of a reliable and efficient development and EPS operation in the new environment. In other words, the process of creating an integrated electric power management system is in progress, corresponding

to the new paradigm of electric power systems arrangement.

According to the terminology of the International Energy Agency (IEA), the term PST (Power System Transformation) means an active process of creating political, market and regulatory conditions, as well as establishing practices for planning the functioning of EPS that accelerates investments, innovations and the use of intelligent, efficient, reliable and environmentally friendly technologies.

The expansion of the use of non-traditional renewable sources of electric energy (RES) was made possible thanks to technological progress in this area, which allowed, first of all, to significantly reduce the cost of electricity production by wind (wind farm) and solar (SPP) power plants of various types. The cost of new SPPs in the world since 2010 has decreased by 70%, wind farm - by 25%.

If initially wind farms and SPPs were built for local consumers and belonged to the category of distributed generation, then at present the capacity of wind farms and solar photovoltaic power plants reaches hundreds and thousands of MW, which transfers them to the category of main sources of centralized power supply. The increased share in the capacity of power plants using RES by 2040 may amount to more than 60% of the total growth (Figure 1).

Key factors contributing to the acceleration of the transformation of energy systems are:

- a strong synergy between energy efficiency and renewable energy;
- increase in the share of electricity production from renewable energy sources;
- expansion of electrification in transport, construction and industry

According to the IEA forecast and the roadmap of energy transformation until 2050 (Roadmap to 2050) of the international renewable energy agency IRENA, fulfilling the growing global energy needs will be fundamentally different from the last twenty-five years: natural gas and rapidly developing RES are trending in energy generation growth, as well as energy efficiency.

Integration of variable (with non-stationary power generation) renewable energy sources (VRE) requires the introduction of certain measures to ensure the economic efficiency and reliability of energy systems as VRE develops.

To solve the integration problems, a number of technical and economic measures are considered, differentiated by the stages of deployment of VRE. To ensure the coordinated work of various types of generating sources, energy transmission and distribution systems, demand management systems, energy storage devices and other systems, integral planning is of key importance, which in the new conditions should include the following elements:

- demand management;
- accounting for the stochasticity of electricity generation by wind farms and SPPs;
- planning and operation of low and medium voltage networks, taking into

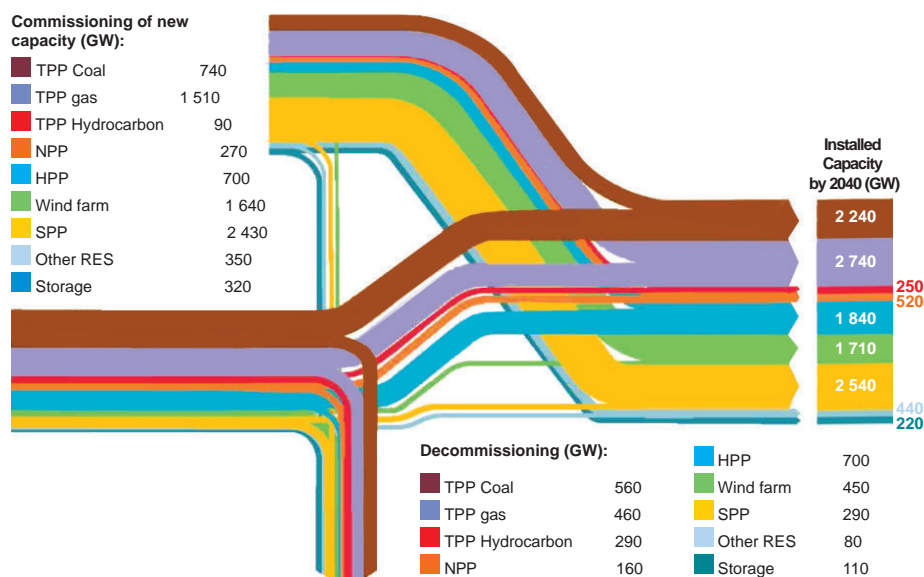


Fig. 1. Worldwide commissioning and decommissioning of generating capacity of power plants

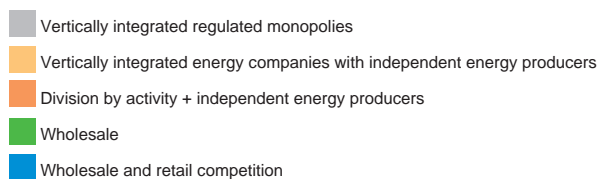
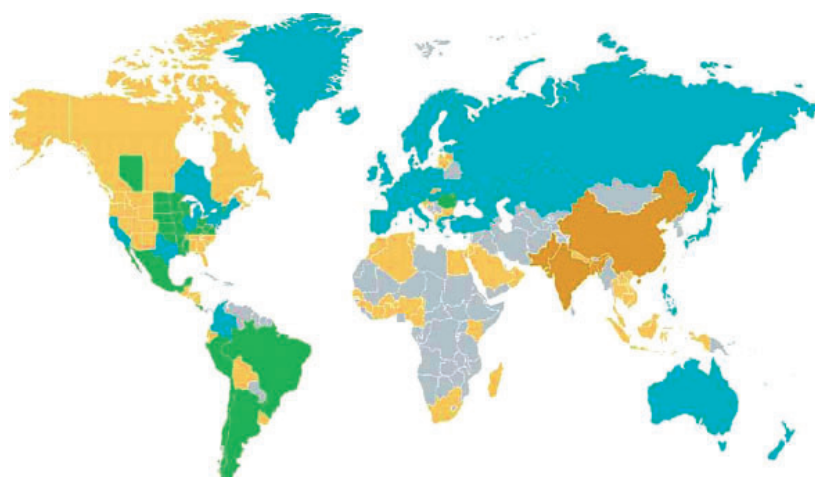


Fig. 2. Map reflecting existing management models in the global electric power industry

account the development of distributed generation;

- integrated planning of the system of generation, transmission and distribution of electricity;
- intersectoral planning between the electric power industry and other sectors, including heat supply, cooling, transportation
- planning, taking into account various regions, jurisdictions, balancing zones.

Technologically, ensuring reliable and efficient operation of EPS in changing conditions leads to new priorities for energy companies and regulatory bodies. The use of advanced information and communication technologies (digitalization) improves the observability and management of electric power systems and opens up opportunities for a significant expansion of demand management. Economically, the growth of distributed generation, the increase in the efficiency of energy storage devices require reforms in retail pricing and taxation of electricity supplies, taking into account payment for the electricity they supply and covering part of the cost of the total infrastructure. The functions and responsibilities of management entities will change institutionally. Priority will be given to improving coordination between transmission and distribution network operators. In addition, completely new actors, such as aggregators, must be included in management. The ongoing process of transformation of energy systems in the world is accompanied by the creation of an appropriate regulatory framework. Considering the possibility of implementing the transformation of EPS

in Russia, it is necessary to take into account the current state and issues of the Russian electric power industry, a detailed analysis of which against the background of the high efficiency and reliability of the EPS of Russia achieved by the end of the 1980s and currently lost. Let's note the key problems and bottlenecks in the current state of the electric power industry in Russia:

- lack of a comprehensive system of strategic planning for the development of the country's electric power industry, taking into account the long-term prospects;
- lack of a targeted vision and long-term projects of electric power industry development in Russia, including the development of AC and DC overhead power lines of high and ultra-high voltage (in the creation of which in the 80s of the last century the USSR was ahead of many foreign countries and that have received significant development over the past years, including in the BRICS countries);
- lack of a comprehensive regulatory framework that should take into account the ongoing processes in the country to increase the diversity of generation sources and EPS components, including the development of distributed generation based on gas turbines, diesel, gas reciprocating, wind farms and solar power plants, electricity producers-consumers, demand management systems, energy storage devices;
- lack of a holistic system for planning research.
- lack of regular funding of R&D activities and innovative technologies creation;

The power industry of Russia is at the beginning of the processes of EPS transformation. According to the data of the Design and Development Program of the Unified Energy System of Russia in 2018, the production of electricity from wind farms and solar power plants as part of the UES of Russia amounted to only 0.98 billion kWh or 0.1% of the total electricity production in the UES of Russia. By 2025, electricity production at wind farms and solar power plants will increase to 10.1 billion kWh or 0.9%. Development of distributed generation in Russia goes at much slower pace than in other countries. At the same time, Russia has significant potential for renewable energy.

In the context of the processes of transformation of EPS in the world, the solution of the following tasks is relevant for our country:

- identifying key areas and a systematic target vision for the development of the country's electric power industry, taking into account the long-term perspective (for the period until 2050), similar to how it was done when developing the GOELRO plan and when determining the plan for prospective studies on the creation of the UES of the country in 1957;
- creation of an institutional framework and an integrated management system that defines the regulatory, technological and economic rules for the optimal development and functioning of the country's electric power complex in the context of the processes of transformation of EPS in the country and worldwide.

S. Ya. Yesyakov, First Deputy Chairman of the State Duma Committee on Energy of the Federal Assembly of the Russian Federation

K.A. Lunin, Ph.D., General Director of JSC ENIN

V.A. Stennikov, Doctor of Technical Sciences, Corresponding Member of the Russian Academy of Sciences, Director of ISEM SB RAS

N.I. Voropay, Doctor of Technical Sciences, Corresponding Member of the Russian Academy of Sciences, Professor, Scientific Director of ISEM SB RAS

I.Ya. Redko., Doctor of Technical Sciences, Professor, Deputy General Director of JSC ENIN

V.A. Barinov, Doctor of Technical Sciences, Senior Researcher, Full Member of Academy of Electrotechnical Sciences of the Russian Federation, Head of Department of JSC ENIN

Based on an article published in "ELECTRIC POWER. Transmission and distribution" # 4 (55) 2019

Yaroslav Sedov, Head of Marketing at Izolyator

Asian market is one of the most important areas of international cooperation development at Izolyator. Let's consider one of the most promising markets in this region - Malaysia.

The marketing department conducted a comprehensive analysis of this region from the economic, political, social and technological sides.

We also carried out an assessment of the electricity market, an analysis of possible threats that could be encountered in the process of work in this direction. As a result, we concluded that this is an actively developing country with high potential, opening up a number of opportunities and a large number of strategies for the Izolyator plant to expand the company's operations in this market.

Malaysian economy ranks fourth in size in Southeast Asia, and 38th worldwide. A higher rating in Southeast Asia is explained by the fact that there are workers in the country who are valued in the labor market due to good education, and the country also has more modern technologies. In addition, recent reports show that in terms of competitiveness, the Malaysian economy ranks 23rd in the world.

Thanks to industrial sector progress, the country has been able to build a diversified and reliable economy. In total, the industrial sector of Malaysia accounts for about 36.8% of the country's GDP and employs almost 40% of the country's workforce. The industrial sector of Malaysia is dominated by manufacturing of electrical appliances, electronics and computers.

The energy market in Malaysia is highly attractive with its increasing growth rate. In the ranking of emerging market countries compiled by Bloomberg in 2018, Malaysia retained first place.

The electricity market consists of 3 major regions.

Each region has a leading company. Tenaga Nasional Berhad (operates in Western and Eastern Malaysia), Sarawak Energy (a state-owned company operating in the state of Sarawak - the largest state in the country), Sabah Electricity (20% owned by the state, operating in Sabah - the second largest state in the country). West Malaysia provides 90% of all electricity demand. Tenaga Nasional Berhad is wholly owned by the government. The company is the largest energy company in Southeast Asia and controls 50% of the generation sector in the country, about 90% of the transmission and distribution segment, and about 75% of the retail market.

One of the key points in choosing a country for international cooperation is Malaysia participation in the Association of Southeast Asian Nations (ASEAN), created in 1967 with the aim of boosting cooperation of the participating countries in economic, social, cultural and other fields, as well as to strengthen peace and stability in the region. Ten ASEAN countries together are the seventh largest economy in the world.

Russia began its cooperation with ASEAN in 1996. Today, bilateral trade between Russia and ASEAN is divided



One of the key factors for choosing a country for a potential partnership is Malaysia's participation in the Association of Southeast Asian Nations (ASEAN)

into three main groups: raw materials, textiles and electronic equipment.

Among the pending ASEAN projects one of the most important in creating a single energy ring between the participating countries by 2030.

In this regard, in Malaysia, projects are underway to create new power lines between neighboring countries. This development scenario opens up opportunities for our company to cooperate with other ASEAN member countries.

Power Industry of Malaysia

3 companies in Malaysia dominate Energy market:

- **Tenaga Nasional Berhad (TNB)** - for Malaysia peninsula
- **Sarawak Energy** - for Sarawak territory
- **Sabah Electricity** - for Sabah and Laban regions.



Tenaga Nasional Berhad (TNB) - the only energy company on Malaysia peninsula, the biggest energy company in South-East Asia with total assets exceeding 1.3Bln USD

Sabah Electricity (SESB) - A TNB branch providing electricity generation, transmission and distribution in Sabah and Laban regions mostly.

Sarawak Energy (SEB) - is responsible for electricity generation, transmission and distribution for Sarawak state of Malaysia. Fully owned by Sarawak state.

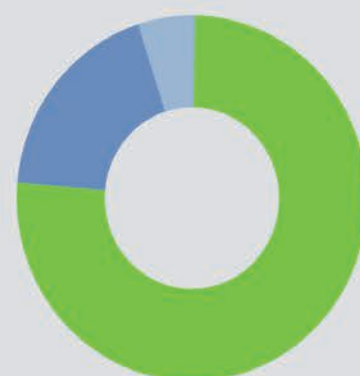
Aside from three mentioned above, there are at least 18 other independent generating companies (Independent Power Producer (IPP)): Malakoff, YTL, Ranhill etc.

Sectors consuming electric energy in Malaysia based on TNB, SESB, Sarawak Electricity Supply Corporation and Northern Utility Resources Sdn. sales (2010):



Manufacturing (34.28%)	Mining (0.05%)
City lights (0.9%)	Agriculture (23.13%)
Utilities (15.96%)	Commerce (25.67%)

Installed capacity structure (2016):



TPP (76.15%)	HPP (18.83%)
RES (5.02%)	



We are looking forward to establish long-term and effective partnerships, while expanding our sales geography.

International cooperation has always been and will be an important part of the work and development of the Izolyator plant. At the same time, we especially value the opportunity to prove the reliability and effectiveness of our technologies through one of the most difficult tests – test of time. We are looking forward to the possibility of establishing just such partnerships – long-term and effective, while expanding our sales geography.

A highly professional team, modern equipment, the highest quality standards and many years of experience – this is the basis thanks to which we manage to win and maintain the trust of partners around the world.

Strengthening partnerships with electric grid companies and generating companies, as well as with transformer plants in Europe and Asia, is one of the most important tasks that Izolyator sets for itself.

In the third quarter of 2019, we continued interaction with power grid companies and manufacturers of energy equipment in China, India, Vietnam, Poland, Turkey, Latvia, Estonia, the Middle East, as well as with our long-standing and reliable partners in the CIS and Russia. We continue to actively supply our products to key energy facilities of the Indian state-owned power grid company Power Grid Corporation of India Limited. The exchange of experience in 2019 between Russian and foreign electric grid companies, as well as between industrial enterprises, has become a reliable foundation for the development of further cooperation between countries, the continuation of the development vector in the field of international exchange of experience with leading grid companies and direct support of Russian industrial enterprises exports.

High-voltage bushings product line-up manufactured by our plant includes more than 360 items of various types and voltage classes. Among these products are bushings for transformers and reactors, for oil circuit breakers, linear bushings. Totally, Izolyator plant manufacturing capacity allows producing 12 thousand high-voltage bushings per year.

For more than 120 years of history, the company has produced more than 620 thousand high-voltage bushings, which are installed on the vast majority of energy facilities in Russia and the CIS

IVAN PANFILOV
Commercial Director
1st Deputy CEO
at Izolyator

countries, as well as in 30 foreign countries. All products comply both with Russian and international standards.

Regardless of the complexity of the projects, lead times for high-voltage bushings are always respected, and in case there are specific customer requests, our experience of production of custom-made bushings that take into account difficult operating conditions surely helps. Today, Izolyator's innovative products are being introduced in different parts of the world, which contributes to the reliability and safety of energy systems.

We've reached leading positions in the development, manufacturing and customization. By now one of the important results of our meetings and talks is the real consideration of Russian energy complex innovative development and intense international cooperation in modernization of high-tech energy equipment. This certainly includes high-voltage bushings with solid RIP insulation being adopted in the energy systems of various countries, as well as the creation of a joint venture with Mehru to manufacture RIP insulated bushings in India.

The creation of an industrial complex in India on the basis of Izolyator plant technologies will make it possible to satisfy the growing needs of the Asian market for these high-tech products, as well as significantly reduce the lead time to Indian energy facilities.

In the third quarter of 2019, we actively worked with our Indian colleagues to prepare the regulatory and technological base for the joint venture. So, negotiations were held with the management of Mehru at which the details of the location of the production site and practical steps to organize production were discussed. During our business trip to China, we held negotiations with manufacturers of hollow composite insulators as potential vendors of the joint venture.

To confirm our full transparency we conducted a series of type tests of high-voltage bushings with solid RIP insulation, which took place this spring at the Central Power Research Institute (CPRI) in Bangalore and Hyderabad in India. The type test program included a full cycle of high-voltage, current and special seismic tests of high-voltage bushings for high and ultra-high voltage classes.

Successful completion of a complex of type tests of high-voltage bushings for voltage 420kV based on CPRI is not only a great honor, but also a great responsibility. Series of type tests of bushings for an ultrahigh voltage of 800 kV still goes on as we are clearly aiming to create product of highest quality.

We appreciate our partners and consumers for cooperation, as well as for the active joint work and support of Izolyator plant in developing a dialogue with international electric grid corporations and integrating innovative products on the world electric power market.

Meetings in China with potential partners of JV Massa Izolyator Mehru



Joint Russian-Indian venture Massa Izolyator Mehru Pvt. Ltd. (MIM) was created by Izolyator plant and Mehru Electrical & Mechanical Engineers (P) Ltd. to produce high voltage bushings with solid RIP insulation in India.

► Talks at Jiangsu Shemar Electric Co. Ltd. in China, which took part Executive Director Mehru Electrical & Mechanical engineers (P) Ltd. executive director Sandeep Prakash Sharma (third from right), Ivan Panfilov and Head of International Business Development Department Andrey Shornikov



▲ Business meeting participants at Jiangsu Shemar Electric Co. Ltd. in China

▼ Business meeting participants at Bushing (Beijing) HV Electric Co., Ltd



Business meetings in India



Participants of the business meeting at Prime Meiden Ltd in Nellore, India

In July and September 2019, Manager of International Business Development dept. at Izolyator, Dmitry Orekhov, held a number of business meetings in India.

Visits to the following enterprises took place:

- Toshiba Transmission & Distribution Systems (India) Pvt. Ltd. transformer plant in the city of Hyderabad,
- State Regional Electric Grid Company Transmission Corporation of Telangana Limited in Hyderabad,

- Prime Meiden Ltd transformer plant in Nellore,
- Transformer plant Prolec GE in Chennai,
- Larsen & Toubro Limited Industrial Company in Chennai,
- Maharashtra State Electricity Transmission Company Limited in the city of Mumbai,
- Transformer plant Siemens Ltd. in the city of Mumbai,
- IMP Powers Ltd. Transformer Plant in the city of Mumbai,
- Transformer plant Transformers & Rectifiers (India) Ltd in Ahmedabad.

All meetings were attended by Dr. Ashok Kumar Singh.

During negotiations with Indian partners, promising areas for the development of mutually beneficial cooperation were evaluated, future joint projects were considered, the advantages of high-voltage bushings with internal RIP insulation and the possibility of installing them instead of analogues with outdated types of insulation were discussed. Results of these business meetings will serve as solid basis for further strengthening and developing of long-term cooperation with leading industrial and energy enterprises in India. ■



Participants in a business meeting at Transformers & Rectifiers (India) Ltd, an Indian transformer plant, L-R: Ashok Kumar Singh, Transformers & Rectifiers (India) Ltd Senior Procurement Manager Vivek Raval and Dmitry Orekhov



Negotiators at the Prolec GE Transformer Plant in Chennai, India



Izolyator plant seminar in Iranian Thermal Power Plants Holding Company

Visit to industrial and energy companies of Iran

Izolyator representatives held a number of business meetings at Iran's industrial and energy companies.

Visits to several transformer plants took place including Arya Transfo Group Transformer Plant in Semnan, Transformer Plant Iran Transfo Corp. in the city of Zanjan, Thermal Power Plants Holding Company in Tehran, Engineering company Monenco Iran Consulting Engineers.

At the meetings Izolyator was represented by Manager of Export Sales Alexander Znamensky and Viktor Kiryukhin, lead technical support specialist.

All events were held with the organizational support and active participation of the Iranian company Fanavaran Pooya Sanat Vafa, which was represented by Member of Board & Executive Manager Mojtaba Nezam and Sales Expert Amir Iranshahi.

Arya Transfo Group

Arya Transfo Group transformer plant was represented by Majid Taran, Head of Electrical Design Dept., A.Ebadipour, Design Manager and Elham Ghafari, Foreign Purchasing Manager.

A tour of the workshops of the Arya Transfo Group plant took place.

During the presentation and subsequent talks, representatives of the Arya Transfo Group plant showed great interest in the products of Izolyator.

Iran Transfo Corp.

At the Iran Transfo Corp transformer plant in the city of Zanjan Izolyator representatives took part in talks with Mr. Moghadam, Head of Design Dept., Ms. Ansari, Foreign Purchasing Manager, Mr. Abati,



Participants of the Izolyator presentation at the Arya Transfo Group Iranian Transformer Plant

Income Inspection Manager, Ms. Afshar, Commercial Expert.

The parties exchanged information on the successes achieved since the previous business meeting.

Thermal Power Plants Holding Company

At the Thermal Power Plants Holding Company in Tehran Izolyator delegation was met by Head of power group Masoud Noori and representatives of TPPH substations.

Representatives of Izolyator plant held a seminar for TPPH technicians serving Iranian power grid facilities. The thematic focus of the seminar was the technical and operational advantages of high-voltage bushings with internal RIP insulation.

Specialists received comprehensive answers to all questions related to the design, production and operation of Izolyator high-voltage bushings. Following the seminar, both parties confirmed their mutual desire to continue cooperation development.

Monenco Iran Consulting Engineers

During a visit to engineering solutions company Monenco Iran Consulting Engineers Izolyator party was met by Mr.Omrani, Ms.Jurabloo, Ms.Danesh Nia, Mr.Fakhrian

An extensive presentation of Izolyator products was held, where the technological features of high-voltage bushings with internal RIP insulation production and their competitive advantages against paper-oil insulation were presented in full detail.

We appreciate all Iranian partners for the warm welcome and productive dialogue! ■

Audit by Southern Korean OEM Hyosung

The transformer plant Hyosung from South Korea made and audit of Izolyator.

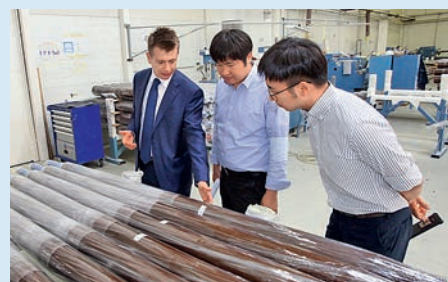
Hyosung plant was represented by Purchase Team Manager Mr. Sim.

General Manager at Artex Corporation trading company Eugene Jang also took part in the audit.

International Business Development Manager at Izolyator Alexander Znamenskiy received the auditors and made a presentation about Izolyator, giving the visitors a tour of the manufacturing plant.

During the audit, Izolyator representatives demonstrated all the technological stages in the production of high-voltage bushings to their counterparts from Hyosung.

The auditors received exhaustive answers and comments to their questions. On Izolyator side, Quality Director Alexander Novikov and Deputy Chief Designer Pavel Kiryukhin also actively engaged in the dialogue. The audit went efficiently and productively. ■



Audit of Hyosung transformer plant, South Korea, in Izolyator

Talks with Saudi Arabia enterprises



▲ Business Development Manager at Saudi Arabian General Investment Authority Mohammed A. Alhadlak and Alexander Slavinsky at the Center for World Culture named after King Abdulaziz in the city of Dahrn, Saudi Arabia

In July 2019, CEO of 'Izolyator Plant LLC' Alexander Slavinsky and Head of Marketing Yaroslav Sedov held a number of business meetings in Saudi Arabia. Negotiations took place in the Ministry of Energy, Industry and Mineral Resources of Saudi Arabia, as well as in the head offices of the following companies: Saudi Arabian General Investment Authority, Saudi Electricity Company, United Transformers Electric Company, Alfanar, Saudi Power Transformers Company. Acquaintance with manufacturing facilities took place at all three transformer plants and talks were held to discuss prospects for long-term and mutually beneficial cooperation. A strong emphasis was given to the discussion of possibility to localize manufacturing of high-voltage bushings in Saudi Arabia in joint partnership with a transformer plant. All plants have shown interest in this form of joint activity. Following the talks, representatives of the transformer plants expressed interest in further exploring the prospects for cooperation with Izolyator. We thank SAGIA and the Association of Business Partners for Cooperation with the Kingdom of Saudi Arabia (ROSA Association) for their assistance in preparing and conducting all business meetings!

▼ Negotiators at the Saudi Power Transformers Company plant in Saudi Arabia, in the center - Saudi Power Transformers Company CEO Josem A. Al Sheikh





Participants in a business meeting at Saudi Electricity Company

Participants in a business meeting at a transformer plant Alfanar in Saudi Arabia, L-R: RUSA Association representatives Andrei Tarasov and Arthur Baykov, Saudi Arabian General Investment Authority business development manager Mohammed A. Alhadlak, Alexander Slavinsky, Yaroslav Sedov



Negotiators at United Transformers Electric Company plant in Saudi Arabia

Russia Kazakhstan cooperation



Visit to the Asia Trafo Plant by Heads of the Consulate of the Russian Federation in Almaty

The Asia Trafo plant was visited by a Russian delegation led by Russian Consul General in Almaty Evgeny Bobrov and Russian Deputy Consul in Almaty Bagir Mamiev. The head of the plant, Sergazy Kuntuarov, led the guests through the territory of the enterprise, spoke about the activities of Asia Trafo LLP, its products and range of services.

Ahead of the visit at the Trade Representation of Russia in Nur-Sultan, Kazakhstan, a business meeting was held between Trade Representative Maxim Kochetkov and GR Director of Alageum Electric, Yernar Dzhakashev.

The parties discussed the implementation of the adopted Roadmap for the development of cooperation between the Republic of Kazakhstan and the Russian Federation, adopted this year. Work in this direction will be continued. ■

Workshop in Kazakhstan Electricity Grid Operating Company

Head of CIS & Baltics Sales Maxim Osipov and Lead Technical Support Specialist Victor Kiryukhin gave a workshop for management representatives of the technical divisions of the Kazakhstan Electricity Grid Operating Company.

At the workshop management of technical divisions of KEGOC was represented by Head of Production and Technical Service Ilmur

Gabdullin, Deputy Head, Substations, Serik Zhanakhmetov, Chief Specialist Diagnostics Malik Nurutdinov, Chief Specialist Diagnostics Didar Akhmetzhanov.

The workshop was mainly dedicated to the advantages of the construction design of high-voltage bushings with solid RIN insulation.

The experts also discussed issues, connected with the specifics of operation and

diagnostics of Izolyator HV bushings that are presently operated at KEGOC facilities.

The workshop went as an interesting dialogue, with KEGOC specialists receiving exhaustive answers and comments on all questions.

The sides marked a high efficiency of the event and expressed a shared intention to develop these forms of cooperations. ■



Workshop of Izolyator in Kazakhstan Electricity Grid Operating Company



Talks of Slavyansk high voltage insulators works management representatives at Izolyator, L-R: General Director Larisa Burlutskaya, co-owner Valentin Rybachuk, Alexander Slavinsky and Maxim Osipov

Visit of Slavyansk high voltage insulators works top-management

In September, management representatives of Slavyansk high voltage insulators works from Ukraine visited Izolyator.

SZVI management was represented by co-owner Valentin Rybachuk and General Director Larisa Burlutskaya.

Alexander Slavinsky, CEO at Zavod Izolyator LLC and Head of Sales CIS & Baltics Maxim Osipov received the guests.

The parties had talks concerning the common targets and strategy of cooperation development in the near and long-term prospect.

The guests went to the corporate museum, where they had an introduction to the century-long history and present-day achievements of Izolyator.

The hosts arranged for a plant tour, familiarizing the guests with the modern technologies of production and testing of high-voltage bushings with solid internal RIP and RIN insulation.

The sides expressed satisfaction with the results of the business meeting and agreed to active develop mutually beneficial business relations. ■



Slavyansk high voltage insulators works management representatives are having an introduction to the history and present-day achievements of Izolyator plant

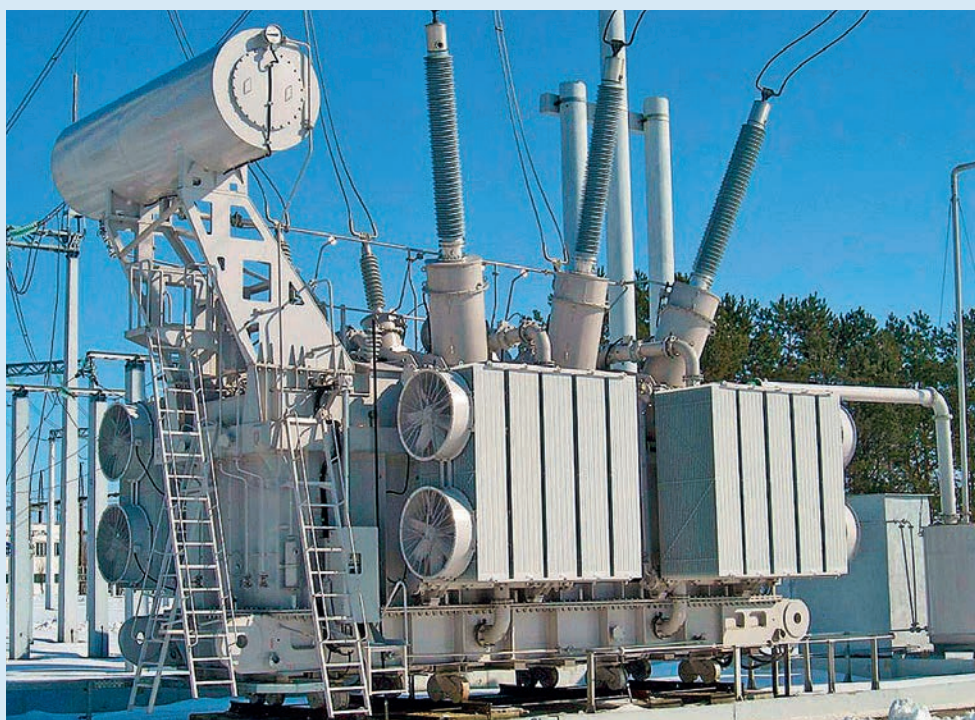
Cooperation with Belenergo of Belarus

State production association of electric power industry Belenergo (SPA Belenergo) organizes a reliable, secure and economically efficient operation and innovative development of production, transmission, distribution and sale of electric and thermal energy.

The State production association of electric power industry Belenergo is controlled by the Ministry of Energy of the Republic of Belarus.

The cooperation of Belenergo and Izolyator has a long and successful history. Transformer and linear bushings with internal RIP insulation for voltage classes from 35 to 330 kV are supplied to Belenergo regional branches and ensure reliable operation of power generation, transmission and distribution facilities.

The implementation of joint projects of the two companies serves to strengthen and further develop the traditionally friendly relations between Russia and Belarus. ■



Transformer with Izolyator high-voltage bushings installed at the 330 kV substation «Brest-1» of the Brestenergo branch of Belenergo company

GEOGRAPHY OF DELIVERIES



- Kentau transformer plant
- Togliatti Transformer
- Vitebskenergo
- GK Dnistrenerg
- ZREW Transformatory

- Balikesir Elektromekanik Sanayi Tesisleri A. S.
- Power machines - Toshiba. High-voltage transformers
- National Electric Network of Kyrgyzstan
- SVEL Group
- TBEA Co., Ltd.

- CG Power and Industrial Solutions Limited
- Siemens AG
- Zaporozhtransformer
- Fortum
- Uralsktrotyazhmash





Andrey Shornikov
Head of International
Business Development
dept. at Izolyator



Maxim Osipov
Head of CIS & Baltics
Sales at Izolyator



Dmitriy Orekhov
Manager of International
Business Development dept.
at Izolyator



The third quarter of 2019 was really eventful. We stepped up to promote our products in the Middle East and Asia.

Izolyator launched sales to the energy market of the Kingdom of Saudi Arabia, becoming an official supplier of high-voltage bushings for transformer plants in this state.

Also, business visits of Izolyator plant representatives to energy companies and transformer plants of Iran and India took place, during which there were presentations of our products, technical seminars, and discussions of joint plans.

In the third quarter, our manufacturing site was visited by representative of the Chinese state-owned power grid company CSG. An audit of Izolyator was carried out by South Korean transformer plant Hyosung.

We continue to strengthen cooperation with companies from the CIS and Eastern Europe continues. Many years of reliable relations with them allow us to build far-reaching plans for the implementation of joint projects.

All this confirms that Izolyator plant has a strong position in international markets, focusing on building long-term, mutually beneficial relations with its partners.



Building trust, an active dialogue with partners is key to business development. In a good partnership, there is a constant exchange of skills, knowledge, experience, which helps participants to reach a new level of development. For Izolyator plant, the traditional form of such information exchange is technical seminars for specialists, which allows us to discuss the most pressing issues in the framework of our cooperation.

So, for example, in the third quarter of 2019, we held a seminar for representatives of technical departments management of the Kazakhstan Electricity Grid Operating Company (KEGOC). During the meeting, we discussed the features of operation and diagnostics of Izolyator high-voltage bushings running at KEGOC facilities, the advantages and design features of innovative RIN insulation and many other interesting issues.

Our partners note the high efficiency of such technical seminars, allowing the exchange of professional opinions and experience. For our part, we thank the partners for their trust, openness to dialogue and interest in cooperation!



The energy complex of India is one of the most intensively developing in the world.

And both long history of relations with India in the field of energy and successful experience of the Izolyator plant in this country allow us to continue active cooperation with our Indian partners.

In particular, in the third quarter of 2019, we paid working visits to India to negotiate several partners and collected several new significant orders of Izolyator high-voltage bushings, as well as conducted technical seminars for specialists from Indian enterprises. Orders resulting from these meetings will allow us not only to strengthen existing ties with Indian partners, but also to open up new prospects for the development of our relations.

In the third quarter of 2019, a large supply of Izolyator plant products was delivered to Prime Meiden Ltd (PML), one of the leading manufacturers of transformer equipment.

This is the first major project with this company, and we eagerly look forward to continued productive cooperation in the future.

EXPORT quarter 2019

BUSHINGS SHIPPED TO



OVERSEAS:

India, Turkey, Poland
Vietnam, China



CIS COUNTRIES:

Tajikistan, Kyrgyzstan,
Belarus, Kazakhstan,
Ukraine, Moldova

MORE THAN

280

Bushings



35-750_{kV}

**SHIPPED
OVERSEAS**

180

Bushings



52-800_{kV}

**SHIPPED TO POWER
FACILITIES OF INDIA**

320

Bushings



**SHIPPED
TO CIS
COUNTRIES**



EXPORT
SHARE
IN TOTAL SALES

20-30

SHIPMENTS
TO 30+
COUNTRIES
IN CIS AND
WORLDWIDE
%



Testing at KEMA Laboratories Prague, Czech Republic



Participants of test of Uralelectrotyazhmash transformer with Izolyator high-voltage bushings at KEMA Laboratories Prague in the Czech Republic, L-R: Vladimir Ustinov, head of the UETM section Nikolay Zhuzhgov, head of KEMA Laboratories Prague Martin Vanis, Maxim Zagrebin, Lead Technical Specialist of Department of Electrical Engineering Oil Transformers Ivan Shcherbakov, three employees of KEMA Laboratories Prague and UETM Assembly shop employee Andrey Melentyev

Transformer manufactured by the Uralelectrotyazhmash plant equipped with Izolyator high-voltage bushings was tested at the KEMA Laboratories Prague in the Czech Republic.

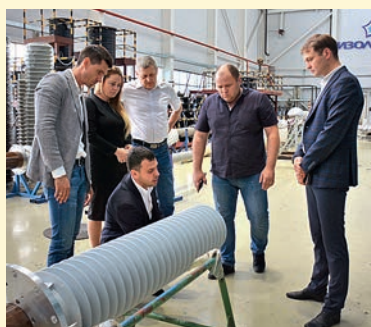
Transformer, equipped with 126 kV / 800 A bushings with internal RIP insulation, was tested for resistance to short-circuit.

These unique tests can only be carried out in a few laboratories around the world.

The Izolyator plant was represented by Vladimir Ustinov, Deputy Quality Director, and Maxim Zagrebin, Head of OEM Sales.

KEMA Laboratories issued a Confirmation about the realised tests were carried out at KEMA Laboratories Prague. ■

Visit of Togliatti Transformer Representatives



Representatives of Togliatti Transformer management at Izolyator assembly shop

Izolyator was visited by representatives of the Togliatti Transformer plant management - Technical Director Andrei Kanivets, Procurement Director Marat Uzbekov, Deputy Sales Director - Head of Service Support Irina Titova.

Guests were welcomed by R&D Director Konstantin Sipilkin, Head of

'SVN-Service' Dmitry Mashinistov, Head of OEM sales Maxim Zagrebin.

At the meeting, the parties summed up the interim results and specified plan of interaction in the implementation of existing agreements.

Parties also discussed ways to develop cooperation and effectively implement promising projects of electrical equipment supply to final consumers' power facilities.

We made a brief tour of production facility for representatives of Togliatti Transformer, during which they became acquainted with modern technologies of production and testing of high-voltage bushings with solid internal RIP and RIN insulation.

Both parties noted the great practical significance of the meeting results. ■

Shipment to SMTT LLC as part of the RusHydro Group project

Another shipment of Izolyator high-voltage bushings to SMTT LLC transformer plant was completed. SMTT transformers specifically designed for the needs of the Federal Hydro-power Generating Company - RusHydro Group, one of the largest Russian energy holdings, will be equipped with customized oil-gas-insulated bushings of 500 kV voltage class.

Fulfilling its obligations in full to develop, manufacture and supply modern insulating equipment, Izolyator plant takes an active part in the modernization and development of the hydropower complex in Russia. ■



Testing of 500 kV Oil - SF6 gas bushings at Izolyator plant



Chief Designer for Transformer production unit of Elmash LLC (UETM) Alexey Borisenko (L) and Maxim Zagrebina at the talks at Uralelectrotyazhmash plant in Ekaterinburg

Talks at Uralelectrotyazhmash

Head of OEM Sales at Izolyator Maxim Zagrebina had talks at Uralelectrotyazhmash plant in Ekaterinburg.

The visitor was received by General Director at UETM JSC Vladimir Kalauschenko, General Director at Elmash LLC (UETM) Sergey Kononenko, Chief Designer, Transformer and Reactor equipment at Elmash LLC (UETM) Alexey Borisenko, Head of Purchasing for Transformer production unit at Elmash LLC (UETM) Leonid Meshavkin.

The sides reviewed the interim results of the joint activities under the existing agreements and went through the details of interaction in the future.

The partners also discussed promising projects for both companies and conditions, necessary for their efficient implementation.

The parties marked the successful progress of cooperation, agreeing on further development and strengthening of business relations. ■

Meeting with management of the Siemens Transformers plant



Participants of a business meeting at the Siemens Transformers plant in Voronezh, L-R: Mechanical Design Team Leader at the Siemens Transformers plant Andrey Tsaregorodtsev, Head of Engineering of the Siemens Transformers plant Andrey Mozul, Maxim Zagrebina and Head of SCM of the Siemens Transformers plant Iskren Cekov

Maxim Zagrebina, Head of OEM Sales at Izolyator, held a business meeting in Voronezh with representatives of the Siemens Transformers plant management: Head of Engineering Andrey Mozul, Head of Supply Chain Management (SCM) Iskren Cekov, Mechanical Design Team Leader Andrey Tsaregorodtsev, Leading Specialist in Strategic Procurement Sofya Filonova.

The meeting participants discussed mutual

goals of cooperation both for the nearest and distant future, clarified the volume of upcoming deliveries this year, outlined the volume of deliveries next year, agreed on the technical characteristics of new equipment.

In addition, Maxim Zagrebina visited production facility, where he got acquainted with modern technologies of transformer equipment manufacturing. ■

SVEL Group and Izolyator plant develop cooperation



Maxim Zagrebina (L) and Purchasing manager at SVEL Group Danila Safin at the working meeting at SVEL Group in Ekaterinburg

Head of OEM Sales at Izolyator Maxim Zagrebina had a working meeting at the industrial group SVEL in Ekaterinburg.

The guest was received by Purchasing manager Danila Safin, Chief Designer 500 kV Denis Guryev, Head of Service Lev Suetin, Representatives of design department Alexander Demashin and Ksenia Pirozhenko

The sides discussed progress of existing agreements, specified the schedule of further activities and work scope on every stage.

Also, the partners reviewed technical and commercial aspects of upcoming joint projects, terms and required resources for their realization.

SVEL Group and Izolyator continue developing their partnership on a long-term and mutually beneficial basis. ■

38 | Controlled shunt reactors of ELECTROZAVOD JSC

Below there are the features of controlled shunt reactors (CSR) designed and manufactured at ELECTROZAVOD JSC.

There are designs and their advantages, described in the article, as well as the test results. CSR's applications for engineering reactive power sources (RPS) are considered below.

The controlled shunt reactors (CSR) have been used at substations (SS) and electric power lines (ETL) for about 20 years proving effective in compensation of reactive power capacity and voltage regulation.

ELECTROZAVOD entered the market of CSR in 2012, when it designed and successfully put in operation a 500 kV 180 MVA controlled shunt reactor at SS

Nelym, type CSRRTD 180000/500, single phase execution (3xROUD 60000/500).

In 2017-2018, ELECTROZAVOD designed and delivered 220 kV 63 MVA three-phase CSRs, CSRRTD-63000/220 to SS Fevral'skaya and Ermak, with two of them in parallel operation at SS Ermak.

CSRRTD-63000/220 is designed in two options. On the construction design part, the two are identical, differing only in the values of nominal current and voltage of the electromagnetic core of the CSR, performance of reactor and capacity of biasing device.

Construction designs of all the reactors are using the uniform principles:

- shell-core reactor, ferromagnetic rod of which contains nonmagnetic gaps;
- the rod of radial construction has variable section with nonmagnetic gaps and even distribution of segments of smaller section along the rod;
- the winding of the biasing is combined with the power winding, i.e. there is no separate control winding used.

Thanks to the application of the rod with variable section and special flux-

current characteristic, ensuring the root-mean-square value of the higher-order harmonics not exceeding 2.3%.

The electromagnetic part (EMP) of CSRRTD-63000/220 is a three-phase device, which contains two identical modules in a tank. The module is a magnetic core with sidelong yokes, three (matching the number of phases) rods (per module). On the rods, there are the power winding and the compensation winding. The power winding of each phase of SCR consists of two windings, located on respective core limbs. The compensation windings are made as two windings on limbs and are in series connection within one phase, triangle connection - for a three-phase arrangement in order to compensate current harmonics multiple of three in reactor.

The neutral terminals of power windings of the three phases of reactors are connected in three, forming up a wiring scheme of the power windings of the three phases «double star with split neutral». The neutral leads of the power

Comparative characteristics of CSR

Parameter	CSRRTD-63000/220		CSRRTD-180000/500 3 x ROUD-600000/500
	SS Fevral'skaya	SS Ermak	SS Nelym
Facility			
Nominal capacity TMP, kVA	1000	4000	5500
Nominal inverted current of coverter, A			
Max inverted voltage, kV	1,8	10	14
Converter insulation class against ground, kV	10	10	35
Capacity change lead time from 5 to 100% or reverse, not more than, s	1	0,2	0,3
Capacity TMP, % of capacity EMC	1,6	6,4	3,1
Overload tolerance of current (not more than 30 min), %	20	20	30
Reserve: Main converter (feed from compensation winding) Back up converter (feed from CH system)	Yes		Without reservation 1 (main) converter with possibility of feed from compensation winding and external CH system
Construction design feature	Container execution of equipment		
Cooling of converters	Liquid-cooled		

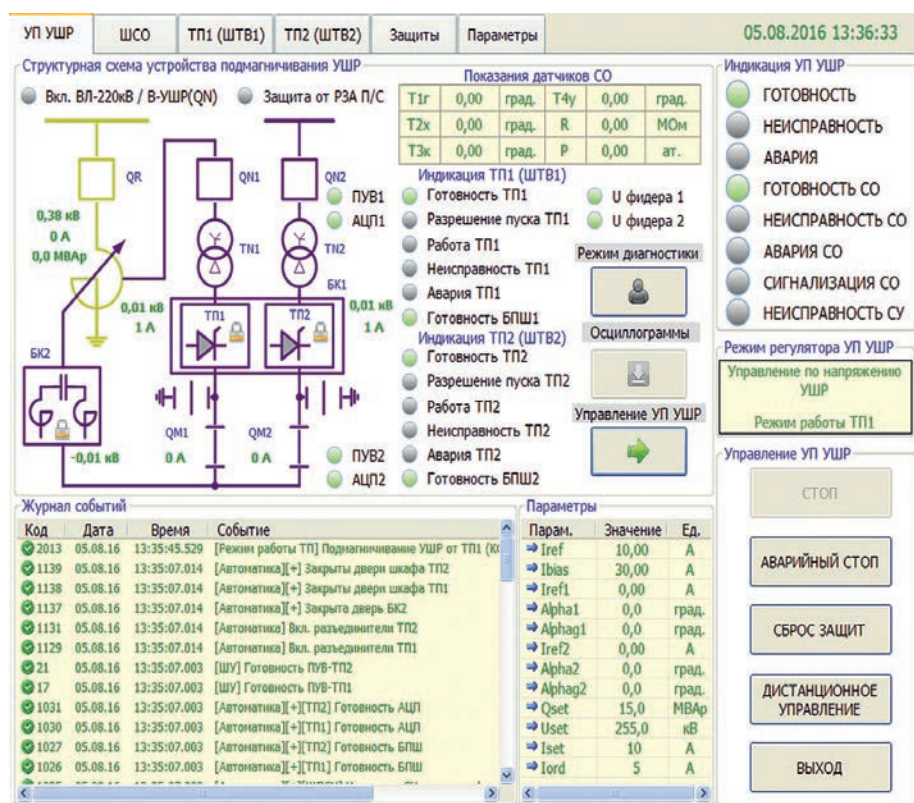


Fig. A view of the main screen of the program

windings of the CSR are grounded through resistors. The line leads of CSR are connected to the corresponding phases of the buses of a substation or ETL with the help of high-voltage circuit-breakers.

Between the neutral leads of the three-phase controlled reactor they use a biasing device with two three-phase controlled thyristor rectifiers: TR1 and TR2 - main and reserve, with systems of control, protection, automation, cooling and switching equipment. Thanks to regulating the direct current in the biasing circuit of the core limbs of CSR the thyristor rectifiers TR1 and TR2 ensure variability of the equivalent resistance of the power winding of reactor and consequently the capacity of the reactor.

All the designed CSRs are equipped with digital control systems that ensure manual and automatic regulation. The control system is built on microprocessor module, using a digital signal processor (DSP) and a set of programmable logic devices (PLD). The unit can be controlled from a local control panel mounted in the container or remotely from the control board of the substation operator on duty via the distant command link of optical fiber. The control interface is realized as a special program, which receives necessary data from the CSR's devices, processes them and displays them on the operator's screen. A view of the main screen of the program is shown on Fig. 5.

The biasing device control system ensures the following operation modes of CSR:

- automatic control on the reactive power of CSR;
- automatic control on the phase current of CSR;
- automatic control on the voltage on CSR's connection buses;
- control on the consolidated signal from external protection (super-excitation, de-excitation of CSR at emergency switching of the ETL's circuit-breakers);
- prescriptive control mode using the settings, received from the APCS of substation;
- manual control mode on the current of biasing of CSR (current of biasing device).

The control system of the CSRRTD additionally ensures and automatic switching from a reserve rectifier TR2 to the primary TR1 after connection of the CSR to the 220 kV network, if the TR operated in the mode of preliminary biasing.

Selection of the rectifiers' operating mode is situational and is made at the signals of the biasing device control system automatically. The engagement and disengagement of the rectifiers is done via an impulse control system.

Besides, the control system carries out the function of protection and fault identification in the rectifiers' operation, possesses a developed system of oscillography, playback and distant transmission

of information in CSR's regular operation and emergency modes.

Over the recent years, there is a growing interest to reactive power source devices based on CSR. There can be two layout options of RPS: switching unit (or several SUs in compensation filter unit - CFU) is connected parallelly to CSR to HV buses; SU (or several SUs in CFU) is connected to LV buses (compensation winding) of CSR. The requirements to SU and CSR features as components of RPS for those two options differ as the regulating characteristics of RPS will change in each case.

Connection to the LV busbar of CFU represented as a filter of the 5th harmonic helps to decrease the total level of higher harmonics in the current of the power winding of the CSR in the entire range of regulation to 1% of nominal current and practically exclude possibility of resonant phenomena in the system caused by a RPS installation, which is a major advantage of the option with connection of SU to LV busbar. The main advantage of the SU - HV bus connection option is the fact that one may use already existing CSRs without need to modify parameters of the electromagnetic part elements to create an RPS. Table 3 shows the list of key advantages of creating an RPS on the basis of CSR.

The controlled shunt reactors, which are designed and made by ELECTROZAVOD JSC are recognized by the following characteristic features and advantages:

- CSR are created using the construction of a shunt reactor with radial rods, rigid nonmagnetic gaps and magnetic shielding of stray flux to ensure a decreased level of additional losses, heating, vibrations and noise.
- The CSRs are made with combined power and control windings, which results in considerable decrease of losses in the reactor.
- Application of the rod with segments of various section, nonmagnetic gaps, distributed alongside the rod and the achieved flux-current characteristic ensure a decreased level of higher harmonics of the reactor current.
- RPS units of various modifications can be designed and made on the basis of CSR.

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*Based on the materials of the article
published in ELECTRIC ENERGY.
Transmission and Distribution Magazine
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Meeting of Technical Council of Rosseti PJSC



The sitting of the Technical Council of Rosseti Group

Izolyator took part in a meeting of the Technical Council of Rosseti PJSC specifically in discussion on High-voltage bushings with RIN insulation

The meeting was led by Deputy General Director - Chief Engineer of Rosseti PJSC, Chairman of the Technical Council of Rosseti PJSC, Andrei Mayorov.

This videoconference meeting was attended by all the electric grid companies of the Rosseti PJSC, Krymenergo, Sevastopolenergo and Regional Electric Networks Group.

The Izolyator Plant was represented by Chief Executive Officer of Zavod 'Izolyator' LLC Alexander Slavinsky and Director of Strategic Sales Alexander Savinov.

Consideration of the topic 'High-voltage bushings with RIN-insulation' began with a report by Alexander Slavinsky, which, based on an analysis of objective factors, showed clear advantages of RIN-insulation and the prospects for mass use of high-voltage bushings with this type of internal insulation.

The speaker noted that currently Izolyator already supplied high-voltage bushings of this type to power grid facilities of Russia and Europe. These are RIN-insulated bushings 110–330 kV for transformers, 35–110 kV for switches, and also 220 kV bushings for current-limiting devices operating on the basis of high-temperature superconductors at minus 200°C.

Representatives of the electric grid companies Krymenergo and Sevastopolenergo stated they have successful experience of operating high-voltage bushings with RIN-insulation and intentions of further purchases.

Taking into account all the above, as well as successful certification of high-voltage Izolyator RIN insulation bushings by Rosseti PJSC, the Technical Council decided to purchase such bushings for 35–500 kV for installation on transformers, autotransformers, oil circuit breakers and reactors, and also to form emergency reserve.

We appreciate Rosseti PJSC for constructive dialogue and their trust in the quality of Izolyator products! ■

Chief Engineer of Rosseti checked the readiness for the Eastern Economic Forum

On September 3, 2019, Deputy General Director - Chief Engineer of Rosseti PJSC Andrei Mayorov during his business visit to Vladivostok checked the readiness of the power grid infrastructure for the Eastern Economic Forum, which will begin its work in September.

Particularly, Head of the Production Unit of the company checked the 220 kV Russkaya substation, the key supply center of the Far Eastern Federal University, which will host the main events of the forum.

In addition, Mayorov inspected the backup power supply system implemented on the campus, and also checked the readiness of the Mobile Center and supervisory personnel to act.

In general, he noted high level of operations at the facilities, good condition of equipment, and the willingness of personnel to solve the possible troubles. No critical issues were found.



Deputy General Director - Chief Engineer of Rosseti PJSC Andrei Mayorov during inspection of 220kV Russkaya substation

Later, Andrei Mayorov held a meeting of the regional headquarters for ensuring the security of power supply for the events of the Eastern Economic Forum. ■

Source: Rosseti PJSC

Working meeting at IDGC Volga

Alexander Savinov, Director of Strategic Sales at Izolyator, held a working meeting at the Interregional Distribution Grid Company of Volga.

The meeting was devoted to analysis of the implementation of existing agreements and coordination of further joint work.

Plans for the development of cooperation in the near and distant future were also discussed. ■



Construction of 110/10kV Posop substation of IDGC Volga

Working meeting at Kubanenergo: further cooperation development

Alexander Savinov, Director of Strategic Sales at Izolyator, held a working meeting with Kubanenergo electric grid company.

At the meeting, we summarized interim results of work on existing agreements, carried out analysis of effectiveness of interaction in the process of fulfilling contractual obligations, and updated plan for further joint work. Parties also

discussed promising projects with the participation of both companies, the estimated timing of their implementation and the preliminary supply volumes of Izolyator high-voltage bushings.

Summarizing the meeting, both parties noted mutually successful course of cooperation and the great potential for its further development. ■

500 kV Preobrazhenskaya Substation of Main Power Systems of the Urals is Put in Operation



Launch ceremony of 500 kV S/S Preobrazhenskaya of Main Power Systems of the Urals. In the rear — Togliatti Transformer autotransformer, equipped with 500 and 220 kV Izolyator bushings

The 500 kV Preobrazhenskaya substation of Main Power Systems of the Urals was put in operation in Orenburg region. The acting Governor of Orenburg region Denis Pasler and FGC UES's Chairman Andrey Murov took part in the official opening ceremony.

The power facility with 501 MVA capacity will supply power to the oil company Orenburgneft, improve reliability of the region's power system operation and transit between the Ural and the Volga, creating a capacity reserve for connecting new consumers.

The Preobrazhenskaya has become the largest investment project of the Federal Grid Company in the region since 2013. The new generation facility boasts modern power equipment. Almost 85 % of the installed equipment is Russian-made.

The autotransformer group by Togliatti Transformer is equipped with 500 and 220 kV Izolyator bushings — a physical result of a close and efficient cooperation of the two companies. ■

Based on FGC UES materials

Training of the Staff of Nizhny Novgorod Enterprise of the Main power system of the Volga Region



Participants of the training of the technical specialists of Nizhny Novgorod enterprise of the Main power system of the Volga Region at Izolyator

Izolyator held a scheduled training of the technical specialists of Nizhny Novgorod enterprise of the Main power system of the Volga Region on the 'Modernization of the measuring tap of high-voltage RIP bushings of Izolyator brand' topic went as part of a joint initiative with the Federal Grid Company of the Unified Energy System to further increase operational reliability of the power facilities of the sector.

The lead commissioning engineers of SVN-Service department of Izolyator under the lead of Dmitry Mashinistov, Head of Department gave the training.

The specialists of Nizhny Novgorod enterprise of MPS Volga had a successful practice according to the methodology, developed for operating staff, and recommendations of SVN-Service experts.

At the corporate museum, the specialists familiarized themselves with the century-long history and present-day achievements of Izolyator.

The training of the specialists of Nizhny Novgorod enterprise of the Main power systems of Volga Region went according to the agreed program, contributing to their skills in operation of Izolyator high-voltage bushings.

The training ended with a presentation of new designs of Izolyator, made by Dmitry Mashinistov. ■

42 | Approaches to creating semi-natural models of power systems



D.B. Gvozdev,
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Engineer at MOESK PJSC,
Associate Professor at EPS Dpt
of the Institute of Electric Energy
part of MPEI

As a result of the intensive informatization of the industry over the past few years, challenges and threats unusual for it have appeared in the electric power industry.

According to the results of studies conducted in recent years, the main information resources of power facilities were vulnerable to cyberattacks: substation automated process control systems, communication systems, digital relay protection and automation terminals, as well as automated control systems for dispatching centers (DECs and EMS).

In addition, cyberattacks are also possible on external digital communication channels of an energy facility (since remote control is often carried out through leased communication channels), which leads to a distortion or substitution of dispatch commands or telemetry values.

One of the approaches to create a fully functional model of a complex system is semi-natural modeling. The concept of semi-natural modeling combines the advantages of both mathematical and full-scale modeling methods and allows almost completely eliminating their shortcomings. Semi-natural modeling involves splitting a complex system into two parts: one part is modeled numerically, and the other is embodied in real physical equipment.

Seminatural modeling is widely used in scientific research in the USA and countries of the European Union. So, in the United States there are several institutes and research laboratories that study the problems of various failures and irregularities in the operation of automated dispatching control systems (ADCS), which use semi-natural modeling technology to build test benches.

In Russia, approaches to the creation of similar models and laboratory com-

The widespread introduction of information technologies and computers at electric power facilities sharply raises the question of ensuring the information security of automated control systems for power facilities. To study the reliability and safety of automated dispatching control systems (ADCS), the scenario modeling method can be applied, which is implemented on the model of an electric power system (EPS). To create this model, it is proposed to use the real-time EPS simulation method with secondary equipment included in the simulation loop: relay protection and automation terminals (RPA), controllers, and smart devices. In this case, the rest of the system (primary equipment of the substation) can be represented by a numerical model. This approach to modeling is called semi-natural or analog-to-digital modeling.

Modeling of the EPS section with relay protection and automation devices included in the simulation loop will allow for the assessment of the consequences for various scenarios of the malfunctioning of a complex electric power system.

plexes are also currently being formed, in connection with which the task of constructing a semi-natural modeling laboratory for cybersecurity research is becoming especially important. Obviously, the architecture of the developed simulator of a complex cyberphysical system should most accurately repeat the architecture of the original system. Therefore, a digital substation built according to the IEC 61850 standard with the ability to remotely control primary equipment from the EMS system of the dispatching center is adopted as the target model (Fig. 1). In addition, for the full-fledged simulation of distributed systems (for example, synchronized vector measurement systems), the model also includes adjacent substations and a control center.

To create such a model, it is necessary to solve several basic scientific and technical problems:

- 1) to develop a mathematical model of the power system;
- 2) to conduct full-scale modeling of automated control systems and relay protection, as well as communication systems;
- 3) to ensure the interaction between the mathematical and physical parts of the model.

There are two fundamental approaches to the mathematical modeling

of EPSs within the framework of the concept of semi-natural models: performing calculations without reference to real time and real-time calculation.

In the first case, the duration of the calculation of each time interval exceeds the time required for the process under consideration in a real system; thus, modeling of short-term processes can take several seconds or even minutes. This kind of modeling is carried out offline and is called, respectively, autonomous or independent modeling. Simulation results are usually stored in specialized files and displayed graphically in the form of time diagrams.

These files can be used for subsequent analysis of processes occurring in the system and signal transmission using analog amplifiers directly to physical equipment (for example, relay protection and automation devices), which provides a link between the mathematical and physical parts of the model.

One of the main advantages of such modeling systems is the fact that there are no restrictions on the size of the simulated power system. An example of a software package for modeling in the so-called «stand-alone mode» is PSCAD software developed by Manitoba HVDC Research Center. This software package allows you to simulate the operation

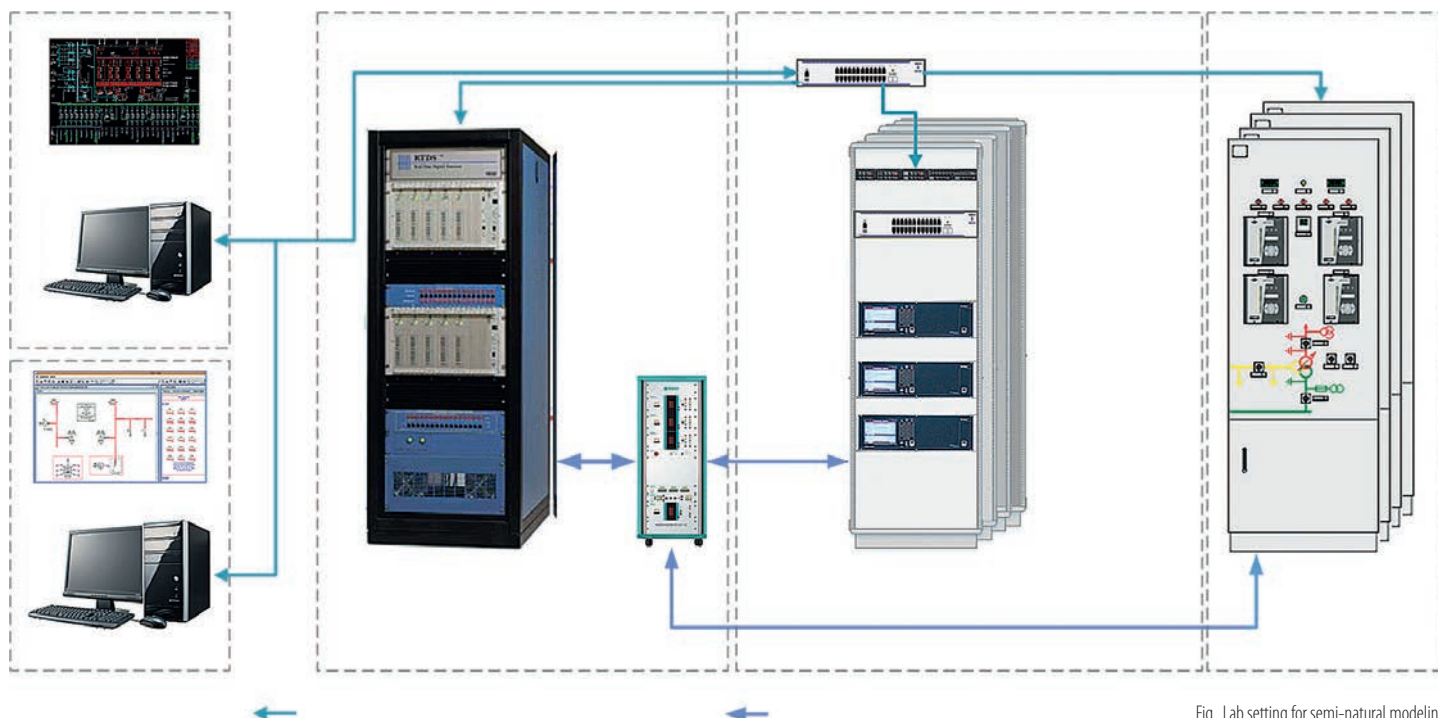


Fig. Lab setting for semi-natural modeling

of energy systems during their design and analysis, as well as build multilayer models of EPS.

However, the use of modeling complexes that do not involve real-time binding of processes does not allow creating a “closed loop” in which there is direct feedback from physical equipment.

The article proposes the basic technical solutions for creating a laboratory complex of semi-natural modeling of EPS. The developed laboratory complex will allow the so-called “scenario modeling”, that is, consider various scenarios of failures, violations, etc. for complex multiply connected systems, as well as to assess the consequences on the basis of simulation results.

The application of the developed cyberphysical model will make it possible to qualitatively increase the level of research carried out for complex multiply connected systems by simulating the actions of operational dispatching personnel (when SCADA systems are included in the modeling loop), modeling the individual characteristics of real electric networks and power facilities, and also the ability to take into account the infrastructure when building the model redundancy, redundancy, the operation of emergency control systems, relay protection, various auxiliary and change systems, etc.

The capabilities of the proposed cyber-physical model are not limited to scenario modeling. Here are some more promising areas of research? 1. Verification of the correct operation of automatic process control and relay protection and automation devices in

the framework of assessing the reliability and safety of EPS. The real-time simulator generates signals close to real EES signals; the presence of feedbacks ensures the interaction of the monitored process control devices or relay protection terminals with the simulated EPS, it is possible to connect several relay protection devices to study their interaction with each other (for example, the simultaneous inclusion of a SCADA server and several relay protection terminals in the simulation loop).

2. Checking the correct functioning of control systems and assessing the risks of loss of controllability for ADCS.

In the framework of this area, studies are being carried out on the correct functioning of automated control systems under various conditions (including the degradation of part of the functions of the system as a result of informational influences from the outside). When considering such scenarios, in addition to the switching equipment of substations (switches, disconnectors and grounding knives), specialized devices can be assigned to control objects, for example, control devices for high-voltage direct current systems (HVDC), controlled by static reactive power compensators (SVC), controlled through thyristors series capacitors (TCSC) and static synchronous compensators (STATCOM).

the modeling of several subsystems at once (while the existing Russian analogues are designed to simulate and verify the functioning of any one subsystem). In the developed laboratory complex, it was possible to simulate at the same time three interacting

levels of the cyberphysical system: the primary equipment of the energy facility is modeled by software, and the relay protection and automation equipment, process control systems and the display and visualization systems are modeled in situ (Figure 5).

It should be noted that the proposed concept was put into practice when creating the laboratory complex for Russian Corporation of Telecommunications CJSC.

At the moment, relay protection devices with connection to the RTDS complex via USO are installed at the laboratory bench, and automated process control systems, including SCADA of the upper level, are also implemented. The laboratory complex is being modernized to provide simulation of digital substations; digital relay protection and automation terminals and an EMS control system are being introduced. If there are several modules in the RTDS simulator, they can be used independently for each task or to combine their computing power to simulate one large EPS model.

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Cooperation with Inter RAO Group



Negotiations at Izolyator were ended successfully: Head of production development department at Inter RAO Group Sergey Samarin and Oleg Bakulin

Our company was visited by Sergey Samarin, head of production development department at Inter RAO Group.

The guest was welcomed by Oleg Bakulin, director of partner relations, who introduced Izolyator plant, its products and practical

achievements in cooperation with business partners both in Russia and all over the world.

Sergey Samarin showed particular interest in innovative products of the Izolyator Company — high-voltage bushings with solid internal RIN insulation. Also during the negotiations successful cases of high-voltage bushings operating at generating and power grid facilities were discussed. The parties expressed their satisfaction with the results of the meeting and agreed to develop business relations.

Also Oleg Bakulin, Director of Partner Relations, paid a working visit to the Kostromskaya GRES, which is a part of JSC 'Inter RAO — Electric Power Plants'. Our partner was represented by the chief engineer Andrey Meshkov and Head of electrical department Dmitry Tumasov. A presentation of the Izolyator plant and its new products — high-voltage bushings with internal RIN insulation took place.

At the working meeting we also discussed the high-voltage bushings operating experience as well as new technical solutions proposed by Izolyator to ensure further increase in bushings reliability and other operational characteristics. ■

Fruitful cooperation with Mosenergo goes on



CHPP-9 of the Territorial generating company Mosenergo

Director of Strategic Sales at Izolyator Alexander Savinov paid a working visit to the head office of the territorial generating company Mosenergo.

At the meeting, the sides discussed the progress of existing agreements and coordination of the upcoming works.

The parties also discussed attractive projects that require participation of both companies: expected timelines and effects.

The working meeting brought the desired result – the successful cooperation between the two companies continues. ■

Izolyator presentation at Konakovskaya GRES

Director of Partner Relations Oleg Bakulin paid a visit to Konakovskaya GRES.

The guest was received by Deputy Director of Production — Chief Engineer Evgeny Sychev, Head of Electrical Equipment Maintenance Sergey Malyshev, Chief Specialist in Relay Protection and Automation (Electrical Equipment Maintenance Service) Vladimir Krasilnikov, Lead Expert of Electrical Equipment Operation (Operations Support Service)

Andrey Rogovtsov. Oleg Bakulin made a presentation of Izolyator's achievement and gave a detailed account of innovative products — high-voltage bushings with solid internal RIN-insulation.

At the talks, the sides spoke about operating experience of Izolyator high-voltage bushings and new technical solution, aimed at having their improved reliability and ease of operation. ■



Oleg Bakulin (R) is giving a presentation about Izolyator at Konakovskaya GRES

Video Conference with Unipro and its Branches



Lead technical specialists of generating company Unipro and its branches are having a video conference with Izolyator representatives

A video conference with participation of Izolyator, generating company Unipro and its branches was held.

The head office of Unipro was represented by Lead Specialist of industrial engineering directorate Sergey Sysenko. The following Unipro's branches were represented by chief specialists: Shatura SDPP, Smolensk SDPP, Berezovskaya SDPP, Surgut SDPP-2, Yayvisnaya SDPP.

From Izolyator, these colleagues attended the meeting: Chief Designer Yuri Nikitin, Director of Partner Relations Oleg Bakulin, Lead commissioning engineer at SVN-Service Alexey Pilyugin.

The video conference opened with presentation of Izolyator, its history, products and key areas of development. The speakers made an accent on the advantages of high-voltage bushings with solid internal RIN insulation. Yuri Nikitin and Alexey Pilyugin gave a detail account of the most recent technical solution development, targeted at gradual improvement of technical and operational feature of Izolyator high-voltage bushings.

Oleg Bakulin summarized experience of operation and diagnostics of Izolyator bushings in a wide range of geographic zones and climate conditions.

The discussion of all topics and issues went in an atmosphere of interest. ■

Successful audit



Lead Electrical Engineer at Kursk NPP Alexander Shelest is auditing Izolyator plant

Izolyator held an audit of production conducted by the Kursk NPP.

The audit task is to assess the readiness of production site for the manufacture of 750 kV voltage class bushings for the needs of the Kursk NPP and Rosenergoatom.

Kursk NPP was represented by Lead Electrical Engineer Alexander Shelest.

Also Dmitry Baturin, Project Manager of Favorstroy company joined the auditing team.

The auditor was welcomed and accompanied by Quality Director Alexander

Novikov and Partner Relations Director Oleg Bakulin.

The audit of all stages of high-voltage bushings manufacturing was carried out in full accordance with the approved program and was completed successfully, confirming the high technological equipment and level of production at our enterprise.

We appreciate Kursk NPP for high valuation of the Izolyator production and technological potential! ■

Presentation of Izolyator at the TGC-2

Director of Partner Relations at Izolyator Oleg Bakulin made a presentation about RIN HV bushings at the head office of the Territorial Generating Company No. 2 in Yaroslavl.

Izolyator presented the advantages of RIN insulation in the construction design of high-voltage bushings, product range and main operating features of bushings using that type of insulation to the specialists of TGC-2.

The presentation raised a strong professional interest and continued with an active dialogue. ■



Arkhangelsk TPP of Territorial Generating Company No. 2

46 | Our Partners - Russian energy enterprises



Participants of the working meeting of TransneftElectrosetService and Izolyator, second left: Deputy Head of Diagnostics at TransneftElectrosetService Sergey Pavlenko

► In August 2019, Oleg Bakulin, Director of Partner Relations at Izolyator, made a presentation at the Perm branch of T Plus Group. Photo: TPP-6 of the Perm branch of T Plus Group





◀ In August 2019, Izolyator plant was visited by top-management of the Leningrad NPP-2 Deputy Director for General Affairs Sergey Efimenko and Deputy Chief Engineer for Electrical Equipment Alexander Rudnik

▶ Leningrad NPP-2 top-management studies technological capabilities of the Izolyator plant



▼ Oleg Bakulin, Director of Partner Relations at Izolyator, made a presentation of high-voltage bushings with RIN insulation at the head office of TGK-1 generating company in St. Petersburg

▼ By the end of the year, the Federal Grid Company will install the latest Izolyator bushings at 27 substations of the Urals (Based on FGC UES materials)





Alexander Savinov,
Director of Strategic Sales
Izolyator



Oleg Bakulin,
Director of Partner Relations
Izolyator



Maxim Zagrebin,
Head of OEM Sales
Izolyator



In the 3rd quarter of 2019, Rosseti held a technical council with the participation of all subsidiary organizations, as well as the power system of Crimea subsidiary (Sevastopolenergo LLC and RK Krymenergo State Unitary Enterprise) and Regional Electric Networks Group. Our plant took part in this event, where we provided information on high-voltage bushings with an innovative type of insulation - RIN, the differences and advantages of this insulation from other types, as well as development prospects.

During interaction at the technical council, we received positive feedback from some branches - Kubanenergo, Krymenergo, Sevastopolenergo, as well as conclusion that there were no restrictions on the operation of this type of insulation and on the contrary, it was recommended for widespread use.

At the first ever All-Russian Congress of Power Industry Professionals in Chelyabinsk, our company presented a booth with innovative products to familiarize the country's power engineers with a new type of insulation in more detail. Samples of high-voltage bushings with RIN insulation aroused great interest of Rosseti management and other guests.

Izolyator plant keeps pace with the times and technological progress, focusing on the needs of the country's power engineers, which allows us to occupy leading positions in the market.



One of the key events of 3rd quarter 2019 is the supply of 330kV bushings to the Leningrad NPP-2 under construction. Izolyator plant manufactured products in accordance with all the requirements of the nuclear power plant and fulfilled all its obligations in full.

The key principle of our work is the maximum satisfaction of consumer requirements for the quality and finished products lead time. We are flexible in terms of delivery terms, and adapt to our customers' special technical requirements that need an individual approach.

We have a firmly established reputation of an enterprise that individually meets the requirements of any customer.

We also increase the volume of technical consultations and seminars with representatives of operating organizations, through both online and in person. So, in the 3rd quarter, we held a technical video-conference for Unipro employees, introducing them to the Izolyator plant innovative products, enterprise development directions, and the latest technical solutions.



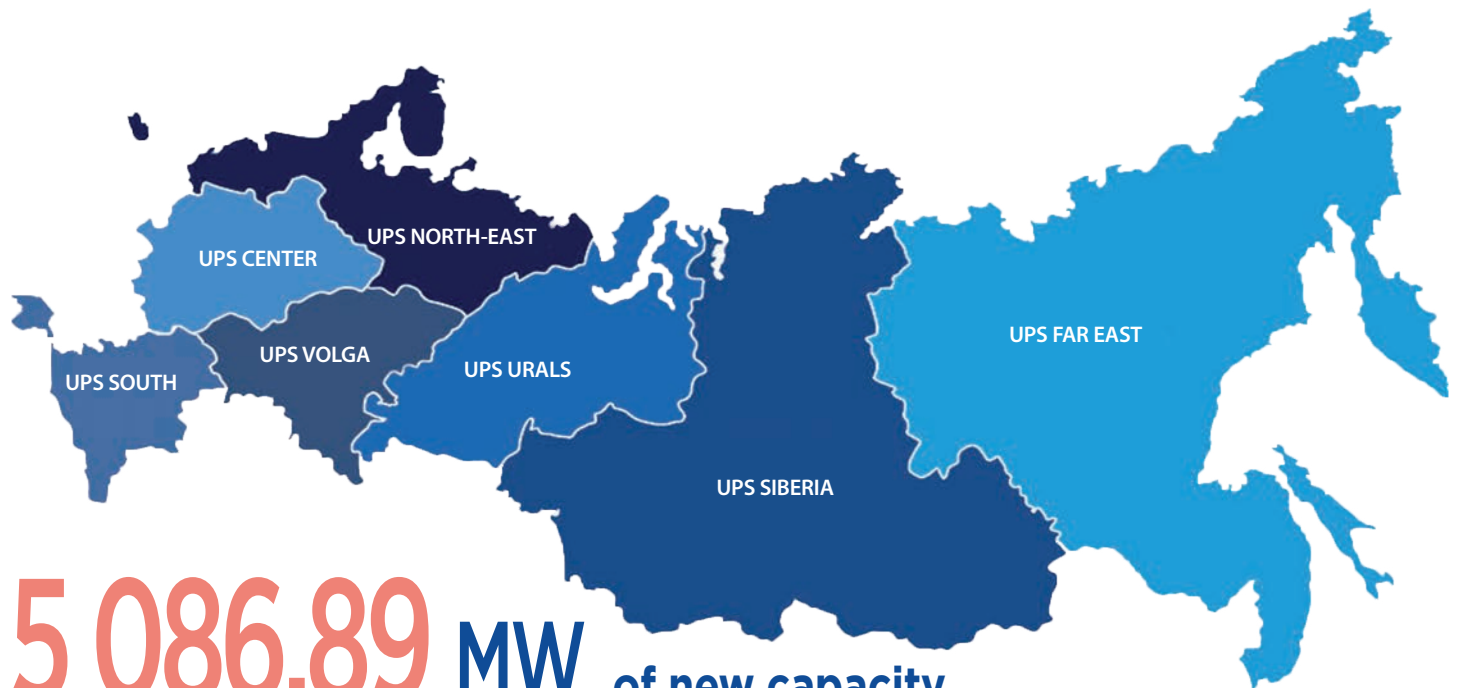
In the third quarter of 2019, we held negotiations and paid working visits to a number of partners. So, the Izolyator plant was visited by representatives of Togliatti Transformer, a representative of JSC Elektroaparat. Excursions to production were carried out, and of course we summarized interim results and specified further plans of cooperation. Similar negotiations took place on the territory of partner enterprises: with SVEL industrial group and Uralelectrotyazhmash (UETM) plant in Yekaterinburg, at the Siemens Transformers plant in Voronezh.

As for large shipments, in the 3rd quarter of 2019, 500 kV bushings were commissioned and delivered to SMTT LLC as part of the RusHydro Group project. In a short time, a batch of 500 kV bushings was manufactured and shipped for the needs of OJSC ELECTROZAVOD. For the first time, the supply of bushings for voltage classes 110-220 kV with RIP insulation for the ATEF Group was contracted. Bushings manufactured and awaiting shipment.

We constantly interact with all our partners – manufacturers of electrical equipment. A number of technical seminars and presentations on RIP insulation are planned for the nearest future, and we are looking forward to this opportunity for creative dialogue and new experience.

POWER INDUSTRY OF RUSSIA III

Quarter
2019



5 086,89 MW of new capacity
commissioned at Russian power plants in 2018

13 303 MVA of transformer capacity
29 965 km of electric grids
commissioned by electric grid companies of Russia

IZOLYATOR

70-80%
MARKET SHARE

High-voltage
bushings Russia
and CIS

>3000 BUSHINGS 24-750 kV
shipped in 2019 to the Unified
Energy System of the Russian
Federation

>320 BUSHINGS shipped in 2019
to transformer plants
in Russia

Visit of Industrial Supply Alfa-Metall Company top-management



Meeting with PO Alfa-Metall top management at Izolyator plant, L-R: Alexander Pankratov, Dmitry Karasev, Dmitry Abbakumov, PO Alfa-Metall Commercial Director Irina Borunova, PO Alfa-Metall General Director Dmitry Trishchenko and Deputy General Director of PO Alfa-Metall Valentin Borunov

Izolyator plant was visited by Industrial Supply Alfa-Metall steel trader General Director Dmitry Trishchenko, Commercial Director Irina Borunova and Deputy General Director Valentin Borunov.

Guests were welcomed by Production Development Director — Deputy CEO Alexander Pankratov, Deputy Commercial Director Dmitry Abbakumov, Head of Purchasing Dmitry Karasev.

Talks were mainly devoted to discussion of strategic issues and prospects of further development of cooperation between the two enterprises.

We also discussed common priorities and tasks, outlined principles of joint activities planning, effective ways to achieve our mutual goals and a number of other strategic issues. ■

Business meeting with Wacker Silicones

A business meeting with representatives of the chemical company Wacker Silicones was held at the Izolyator plant. Wacker Silicones was represented by SER Sales Director Jürgen Ismeier and Sales Manager / Engineering Silicones CIS of Wacker Chemie Rus Mikhail Spirin. Our party was represented by Production Development Director — Deputy CEO Alexander Pankratov, R&D Director Konstantin Sipilkin, Head of Purchasing Dmitry Karasev, Chief Technologist Svetlana Kryuchkova and Team Leader at Purchasing dept. Yuri Kukhtin.

The parties specified the schedule for the supply of organosilicon compositions under existing agreements and outlined 2020 plan.

Also, representatives of Wacker Silicones and a special design and technology bureau discussed the possibilities of joint work in the framework of promising projects.

Representatives of Wacker Silicones visited manufacturing facility, and in particular, the casting section of polymer external insulation of high-voltage bushings. ■



Representatives of Wacker Silicones company at Izolyator plant, L-R: Sales Manager / Engineering Silicones CIS of Wacker Chemie Rus Mikhail Spirin, SER Sales Director Jürgen Ismeier, Svetlana Kryuchkova and Dmitry Karasev

Talks with PPC Insulators



Dmitry Karasev (L) and PPC Insulators CIS Sales Manager Ivo Kamen

Izolyator was visited by representative of the industrial company PPC Insulators - Russia and CIS Sales Manager Ivo Kamen.

Negotiations with our guest were led by Head of Purchasing at Izolyator, Dmitry Karasev.

During the talks we discussed the possibility of using porcelain insulators manufactured by PPC Insulators as external insulation of high-voltage bushings.

The parties agreed to expand the dialogue and make certain steps in this direction. ■



Participants of the meeting at Izolyator plant, L-R: Dmitry Karasev, General Director at Impel Dmitry Martyshevsky, Dmitry Abbakumov and Taitana Sheina

Doing business with Impel company

Izolyator Plant was visited by Dmitry Martyshevsky, General Director of Impel. The guest was welcomed by Deputy Commercial Director Dmitry Abbakumov, Head of Purchasing Dmitry Karasev, Team Leader at Purchasing Dept. Tatyana Sheina. The parties discussed

the progress of joint work and outlined further steps of practical cooperation improvement.

Much attention was paid to planning and development of mutually beneficial and long-term cooperation. ■

80th Anniversary of Dubna Machine Building Plant

Izolyator took part in celebrations of the 80th Anniversary of Dubna Machine Building Plant named after N. P. Fedorov.

The plant opened its territory for everyone interested and willing to get an introduction to the plant's activities.

Leader of purchasing group Yury Kukhtin congratulated the heroes of the day warmly on behalf of Izolyator. ■



At the 80th Anniversary of Dubna Machine Building Plant named after N. P. Fedorov, L-R: Deputy General Director — Commercial Director at Dubna Machine Building Plant named after N. P. Fedorov Alexander Panteleev, Yury Kukhtin and General Director at Dubna Machine Building Plant named after N. P. Fedorov Egor Soloviyov

Visit of the Italian Cartiera di Nebbiuno Srl's Representatives

Representatives of the Italian quality crepe papers Cartiera di Nebbiuno Srl paid a visit to Izolyator - Sales Specialist Paolo Buzio and Lilia Smolova, General Manager of Cartiera di Nebbiuno Srl's representative in Russia — Izolanti.

On Izolyator side the guests were received by: Dmitry Abbakumov, Deputy Commercial Director, Dmitry Karasev, Head of Purchasing, Yury Kukhtin, Group Leader Purchasing, Pavel Kiryukhin, Deputy Chief Designer.

The parties discussed technical aspects and application prospects of crepe paper of Cartiera di Nebbiuno Srl as the main insulation of high-voltage bushings with RIP insulation.

During a plant tour the guests familiarized themselves with the key stages of production and testing of HV RIP bushings.

The sides agreed to carry on with bilateral business contacts and take practical steps in setting up an efficient form of cooperation. ■



Representatives of the Italian company Cartiera di Nebbiuno Srl at Izolyator, L-R: Yury Kukhtin, Sales Specialist at Cartiera di Nebbiuno Srl Paolo Buzio, Pavel Kiryukhin, General Director at Izolanti Lilia Smolova, Dmitry Abbakumov and Dmitry Karasev

Opening of the multifunctional service center “My Business” in Istra



Grand opening of “My Business” Service Center in Istra

Chief Executive Officer of Zavod ‘Izolyator’ LLC, Alexander Slavinsky, took part in the opening ceremony of the Service Center “My Business”

in Istra. This is the ninth “My Business” center opened in Moscow region. The ceremonial event was attended by Minister of Investment

and Innovation of the Moscow Region Mikhail An, head of the Istra district Andrey Vikharev, director of the Investment Development Agency of the Moscow Region Vladimir Zaitsev, Vice-President of the Chamber of Commerce of the Moscow Region Alexander Stupin and representatives of the business community of the district.

Istra is part of the “golden mile” of the Moscow region, a place with great potential, said Mikhail An. “In five years, irreversible changes should take place here, which in a quarter of a century will make it an example of the best practices of the urban structure, such as the suburbs of the largest agglomerations of the world.”

“In 2019, we began work to transform the Istra city district into the largest investment cluster of the Moscow region”, – the minister added.

Implementation of this investment strategy will not only accelerate the development of the district’s economy, but will also create new jobs, which means that one of the leading principles of the “governor’s strategy” will be followed, namely, “The ability to work where you live.” ■

Working meeting at the Ministry of Investment and Innovation of the Moscow Region

Representatives of Izolyator management took part in a working meeting that the Ministry of Investment and Innovation of the Moscow Region held with enterprises and organizations - developers and manufacturers of electrical equipment.

The purpose of the working meeting was to ensure the implementation of strategic directions of the social and economic development of the Russian Federation and Moscow Region until 2020 and for the period until 2030. At the meeting Izolyator was represented by General Director of Massa LLC Sergey Moiseev and Deputy

Commercial Director of Massa LLC Dmitry Abbakumov.

At the meeting issues of ensuring stable and efficient operation of business entities were discussed; the causes of problem situations that impede the competitive products rollout both for domestic and export sales, as well as a number of other pressing issues.

At the end of the working meeting, the participants specified the expected development indicators of enterprises and organizations - manufacturers of electrical equipment in 2019 and in the near future. ■



Dmitry Abbakumov (foreground) and Sergey Moiseev at a working meeting arranged by the Ministry of Investment and Innovation of the Moscow Region

Workshop at the Chamber of Commerce and Industry of the Moscow Region



Workshop at the Chamber of Commerce and Industry of the Moscow Region

Izolyator took part in the workshop on Practice of increasing exports to the countries of the European Union, which was held by the Fund for Supporting Foreign Economic Affairs jointly with the Chamber of Commerce and Industry of the Moscow Region.

At the seminar Izolyator plant was represented by Deputy Commercial Director Dmitry Abbakumov and Manager of Export Sales Alexander Znamensky. ■

in **III** quarter 2019 individual training given to **17** staff members **4** staff members raised qualification **3** specialists mastered a secondary profession

Best HR specialist



Julia Tyurina, Human Resources Manager at Izolyator plant

Human Resources Manager of Izolyator plant Julia Tyurina became a finalist of the professional mastery contest in human resources management under the nomination «Staff assessment and development». Over 1000 managers and specialists of HR departments from more than 30 federal subject of RF participated.



The open professional contest «The Best specialist in human resources management» was organized with support of the Ministry of Labor and Social Security of Russian Federation in Samara.

It pursues the objective of professional development of specialists in HR management as pertains to the current professional standards as well as promotion of best practice therein. ■



Community of the Serbian city of Bečej and the Istra city district administrations representatives at Izolyator plant

Visit of the Serbian city of Bečej and the Istra city district administrations representatives

Izolyator plant was visited by administrations representatives of the Serbian city of Bečej community and the Istra city district. In the framework of municipal cooperation between friendly regions, the Serbian delegation annually comes to the celebration of Istra City Day and visits various cultural and industrial sites of the Istra city district.

The Bečej community delegation included: community leader Dragan Tošić, Head of the Department of Public Utilities and Water Supply of the Community Bojan Đurović, Head of the community finance department Tatjana Krstic, Sandra Popov, Head of Community Economics Advisor to the Chairman of the Council of Communities Dragutin Jelenic, Jovana Topic, member of the community.

The Istra city district administration was represented by Head of Regional

Development Department Natalya Karskova, Head of control and organization department Natalya Yastina, Lead expert of control and organization department Yulia Gagarina.

General Director of Massa LLC, Sergey Moiseev, introduced the guests to the activities of the enterprise and its role in the development of domestic and world electric power industry.

Alexander Znamensky, manager of export sales, conducted a tour of the enterprise's workshops, where guests examined advanced technologies of modern energy equipment production.

At the end of the visit, our guests expressed gratitude for the hospitality and gave high assessment to the technological level of enterprise. ■

54 | In focus: development of the Moscow region industrial potential



In July 2019, Vladimir Golovnev, Moscow Region Business Ombudsman, and Igor Kuimov, President of the Chamber of Commerce and Industry of the Moscow Region, held a working meeting at the Izolyator plant on the development of the industrial potential of the Moscow region. Foreground, L-R: President of the Chamber of Commerce and Industry of the Moscow Region Igor Kuimov, Moscow Region Business Ombudsman Vladimir Golovnev and Alexander Slavinsky

► Participants in a working meeting on the development of the industrial potential of the Moscow Region in the assembly shop of the Izolyator plant.



▼ Interview with the Moscow Region Business Ombudsman Vladimir Golovnev at a working meeting at the Izolyator plant on the development of the industrial potential of the Moscow Region



▲ Igor Kuimov, President of the Chamber of Commerce and Industry of the Moscow Region, gives an interview at a working meeting at the Izolyator plant on the development of the industrial potential of the Moscow Region

► Alexander Slavinsky gives an interview to regional media about the prospects of Izolyator plant development



▼ Participants of a working meeting on development of the industrial potential of the Moscow Region in the test center of Izolyator plant



56 | Izolyator volleyball team named as 'Breakthrough' of the City Cup



Participants of the City Cup volleyball tournament

Izolyator team took part in the City Cup tournament in volleyball among corporate teams of the Central Federal District. The Moscow City Day Tournament was organized by Pinkov Sports Projects and was held at the Metallurg Sports Arena.

The teams represented many enterprises of the Tver region, Kaluga region, Saint Petersburg, Nizhny Novgorod and, of course, Moscow. Main Metrological Center of the State Service of Time, Frequency and Determination of the Parameters of the Earth Rotation (MMC SSTF), Pipe Metallurgical Company (TMK), Roszheldorproject, Izolyator Plant, CROC, Elins Scientific and Technical Center, SIBUR IT, SIBUR-PETF, Kaluga Research Radio Engineering Institute (KNIRTI), Moscow Television Research Institute, State Corporation for Air Traffic Management of

the Russian Federation, St. Petersburg Information and Analytical Center - this is the list of tournament participants.

At the opening ceremony, General Director of OOO Massa (Izolyator plant) Sergey Moiseev addressed the audience with his greetings. He noted how important and necessary sport is in the life of every employee of the enterprise: 'I believe that corporate sport is extremely necessary, as it gives health to the employee. It goes without saying that during the game the true corporate and team spirit is being developed'.

The Izolyator team debuted in the tournament and from the first games demonstrated a high level of skill and team spirit. Following the results of the matches played, by a unanimous decision of the judges, our

team was awarded with 'Breakthrough' title and cup.

Sergey Moiseev: 'We arrived with a fighting spirit. Our team is young and we debut in such a tournament. Two years ago, when we just built our own gym at the factory, we started practicing team sports. The first team, of course, was football: they started their journey from the last lines in the standings, and now we are not only taking prizes, but just recently they won a gold cup in the tournament. Therefore, we hope that our volleyball team with each new tournament will only improve over time and take prizes.'

The most invaluable reward of any tournament is, of course, the emotions of players and fans. Huge thanks to all the participants and fans who came to support our team!

► The Izolyator team is awarded with 'Breakthrough' Cup



◄ In the game — the Izolyator team

▼ City Cup tournament awards awaiting their heroes



▼ Passionate fans are half the team's success



58 | Izolyator team wins Pavlovskaya Sloboda Football Cup 2019!

Izolyator team won Pavlovskaya Sloboda Football Cup, which was timed to coincide with the Day of the Athlete. Congratulations to our champions on the bright victory, thank you for the spectacular game and wish you new sports achievements!

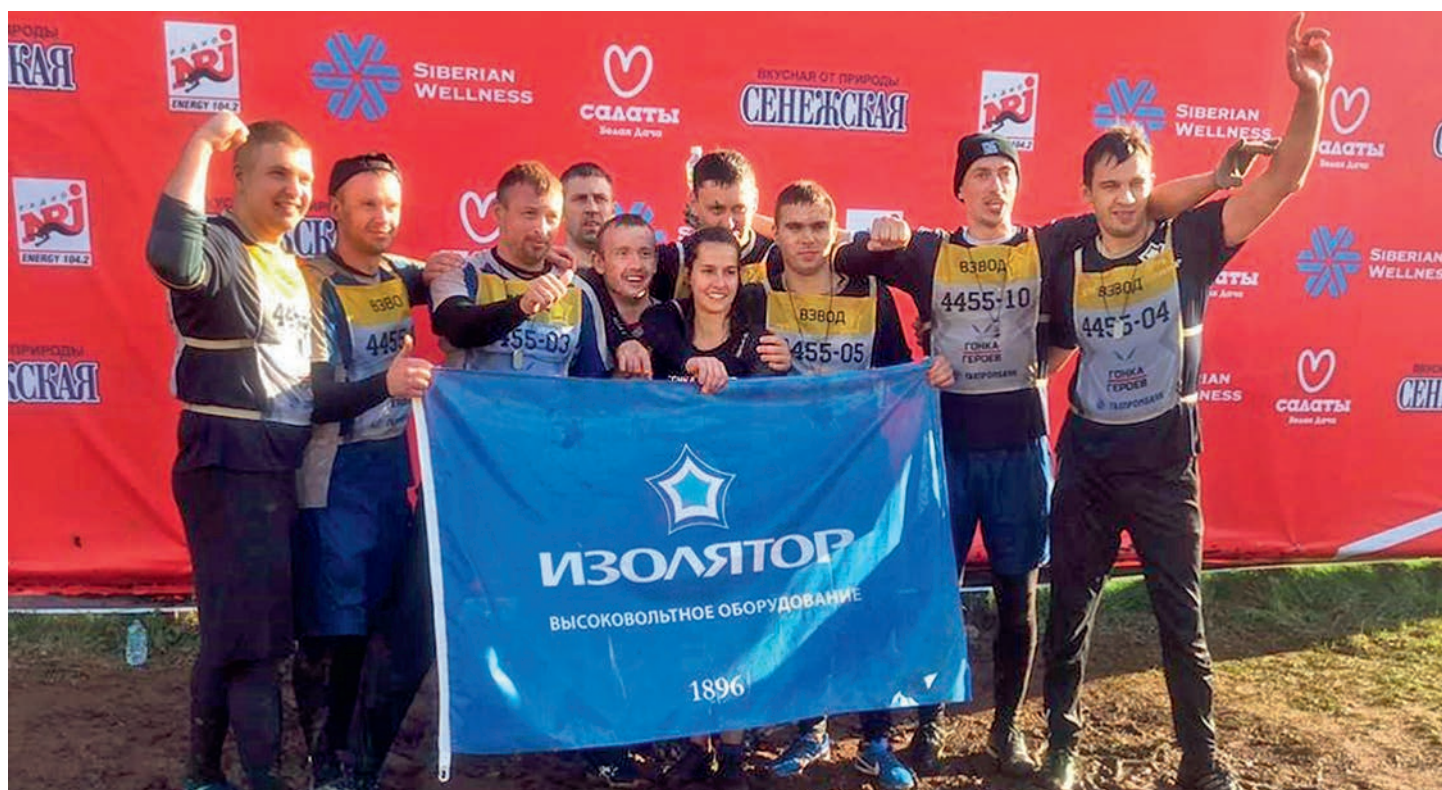


► Izolyator Team - Winner of Pavlovskaya Sloboda football Cup 2019

▼ The Cup is awarded to the Izolyator Team

▼ On the field - the Izolyator team





The Izolyator team is a participant in the Race of Heroes at the Alabino military training ground in the Moscow Region

The Izolyator team took part in the Race of Heroes

The Izolyator team took part in the popular Race of Heroes obstacle course at the Alabino military training ground in the Moscow Region.

Many teams were waiting for this particular race, as it is here that the conditions are close to military and extreme.

On the obstacle course, 32 of 129 teams met who were selected at the regional stages of the competition. The route of the Alabino 10 kilometers training ground had 40 obstacles: numerous hand paths, cross-country running, board obstacles, logs and barbed wire, high-rise structures and "mud baths" - ditches filled with water, which were present in excess on the participants' path.

The Izolyator team also had to crawl under the T-72 tank!

We thank the Izolyator team for the spectacular passage of the obstacle course, as well as the fans who actively encouraged the runners throughout the course!



Hand obstacle pass



Psychological stability exercise - crawling under the tank

OUR PARTNERS

We appreciate all our partners



Inter RAO Group is a diversified energy holding, managing assets in Russia and European and CIS countries. The group's activities include production of electric and thermal power, wholesales of energy, international trading, engineering, export of power equipment, management of distribution networks outside Russia.



«Alageum Electric» is the largest electrical holding company in Kazakhstan, which includes more than 30 large enterprises and factories, successfully operating in the electric energy sector, electrical engineering and construction. The products of Alageum Electric meet Kazakhstan's and international quality standards and are exported to the CIS and Middle East countries.



Balikesir Elektromekanik Sanayi Tesisleri A. S. (BEST) is a manufacturer of high-quality and reliable distribution and power transformers. BEST is the largest national manufacturer in Turkey, which enjoys reputation of a reliable supplier to more than 50 countries.



The Public joint stock company of energy and electrification Mosenergo (Mosenergo PJSC) is currently the largest territorial generating company in Russia and one of the largest heat producers in the world. Mosenergo PJSC is a daughter company of Gazprom PJSC.



CG Power and Industrial Solutions Limited (CG), earlier known as Crompton Greaves Limited, has received its new name on 27 February 2017. CG is an engineering conglomerate with a 2 bln USD turnover and a wide range of products, solutions and services for the power industry. It is a part of Avantha Group.



International Council on Large Electric Systems (Conseil International des Grands Réseaux Électriques – CIGRE) is the largest international non-profit Association in power industry. It is one of the most authoritative and significant international scientific and technical associations.



Founded in 1964, EMCO Limited is one of India's leading products and solutions providers up to 765 kV/ ± 800 kV for power generation, transmission, distribution utilities and industry. The products and technical solutions of EMCO Limited meet requirements of national and international standards IS, IEC, ANSI and are sold in more than 50 countries of the world.



The state power company of Vietnam EVN National Power Transmission Corporation (EVN NPT) was founded in 2008 as result of reorganization of activities of four transmission companies: Power Transmission Company No. 1, 2, 3, 4 and three power project management offices – Northern, Central and Southern.



GE T&D India Ltd makes equipment for power transmission on large distances, such as: switchgear for substations with air or SF6 insulation, circuit breakers, power transformers and measuring transformers.



IMP Powers Ltd., a flagship company of the \$120 Million IMP-Mangalam group, is a name to be reckoned with in the manufacturing of transformers and reactors up 315 MVA and up to 400 kV. This is one of the leading transformer companies of India in the equipment segment 132/220 kV with a park of over 35 000 transformers all over the world.



KME Germany GnbH & Co. KG is a European industrial concern that makes and sells semis and finished products from brass and brass alloys with leading position in the world. KME is an global compation with a developed network of representations on five continents.



Kolektor Etra d.o.o. is a manufacturer of power transformers and generators up to 500 MVA and up to 420 kV. The plant has a modern laboratory to test transformers, equipped with sensitive measurement instrumentation, allowing for making accurate measurements and provide reliable results.



Mehru Electrical & Mechanical Engineers (P) Ltd. makes measuring transformers up to 420 kV. The company is a leading supplier of measuring transformers for numerous customers both inside India and the rest of the world: the products of the company are exported to 30 countries.



Maschinenfabrik Reinhausen GmbH (MR) is a leading company within the Reinhausen Group. For 30 years, MR has designed and manufactured insulation tubes from glassfiber reinforced epoxy resin. Since 2009, these insulators are made by Reinhausen Power composites GmbH, a 100% subsidiary of MR.



Power Grid Corporation of India Limited (PowerGrid) is an India-based state power grid operator engaged in construction, operation and maintenance of inter-state transmission system. This is one of the largest companies for electric power transmission in the world. The company is largely specialized in construction and operation of electric networks in India.



TBEA Co., Ltd., based on the advanced experience of power facilities construction in China, offers ecological, intellectual, reliable and highly efficient power equipment in more than 70 countries and regions of the world.



The Transmission Corporation of Telangana Limited (TSTRANSCO) was founded in the result of India's power industry reform. In 2014, APTRANSCO was divided into regional grid companies TSTRANSCO and APTRANSCO.



Toshiba Transmission & Distribution Systems (India) Pvt. Ltd. (TTDI) is a transformer manufacturer since establishment in 2013. Toshiba Transmission & Distribution Systems group of companies is a global leader in delivery of integrated solutions for transmission and distribution of electric power.



VUJE a.s. is an engineering company, which is engaged in project, contractor, sales, research and training activities mainly in nuclear and traditional power industry. All the projects are done for the customers on turn-key basis, ie. a project is fulfilled from design documentation to completing complex testing.



Wacker Chemie AG is multinational chemical company, headquartered in Munich, Germany. Its division Wacker Silicones is among the world's biggest manufacturers of silanes through silicones. Wacker Silicones supplies components of organosilicon compound to Izolyator for high-voltage bushings' polymer external insulation making.



ZREW Transformatory is based in Lodz, Poland. The company has worked on the market of transformers for over 60 years. It manufactures, maintains, modernizes and runs diagnostics of oil power transformers.



The state production association of electric energy Belenergo (SPA Belenergo) organizes secure, reliable, economically efficient operation and innovative development of production, distribution and sales of electric and thermal energy.



VNIIR Hydroelectroautomation JSC offers its customers a complete services range in design, configuration, supply, installation, commissioning and putting into operation of power facilities. The enterprise operates as a full cycle engineering company.



JSC Georgian State Electrosystem (GSE) is a power grid system operator, rendering services in electric power transmission and exclusive dispatch services all over the country. It also controls the power lines of interstate transmission, which connect the country with its neighbours: Russia, Turkey, Armenia and Azerbaijan.



ATEF Group is specialized in the manufacture of high-quality electrical equipment and turnkey services of substation installation for industrial, utility, transportation and energy sector customers. The technologies that ATEF Group created are exported to 35 countries of the world.



SverdlovElectro Group (SVEL Group) is a leading power equipment manufacturer in Russia. The company boasts one of the impressive growth modernization rates in the industry. Cooperation of SVEL Group with the key Russian companies allows for an efficient contribution to the Government program of import substitution.



State Unitary Enterprise GC Dniestrenergo (SUE GC Dniestrenergo) services 35–330 kV substations and power lines and effects the central dispatch control function over the energy system of Transdnestr Moldavian Republic.



Zaporozhtransformator (ZTR) is the largest in CIS and Europe company to manufacture oil power transformers and electric reactors with production capacity 60 thnd MVA per year, concentrated on a single manufacturing site. ZTR trademark is well-known for an exceptional operational reliability of equipment.



The state unitary enterprise of the Republic of Crimea Krymenergo (SUEP RC Krymenergo) is the largest power company of the Crimea that was created to ensure stability of the power grid operation and energy security in the region. The service area of SUE RC Krymenergo is the whole territory of the Crimean peninsula.



National Power Grid of Kyrgyzstan (NGP Kyrgyzstan) is an energy company, which transport electric power, produced by power plants via high-voltage power lines across the entire Kyrgyzstan to distribution companies and large industrial consumers.



The Public listed company Rossiiskie Seti (Rosseti PJSC) is a power networks operator in Russia, one of the biggest power grids in the world. The company manages 2.3 mln km of power networks, 490 thnd substations with transformer capacity exceeding 761 GVA.



The Public Listed Company Federal Hydrogenerating Company – RusHydro Group – is one of the largest Russian energy holdings. RusHydro is a leader in electric power production from renewable sources of energy, which develops generation on the basis of energy of water streams, sea tides, wind and geothermal energy.



Unipro PJSC (E.ON Russia JSC until June 2016) is the most efficient company of the thermal power generation sector in the Russian Federation. Unipro PJSC consists of five heat power plants. Company's core operations comprise electric power and capacity generation and sales.



Sverdlovsk branch of T Plus Group comprises generating and thermal assets in seven cities of Sverdlovsk region. There are six power plans (TPS, SDPP, HPP) within its structure and in operational control - Ekaterinburg heat supply company, Sverdlovsk heat supply company and Engineering and technical center of Sverdlovsk region.



Power Machines – Toshiba. High-voltage transformers Ltd is a joint venture of Power Machines JSC and Toshiba Corporation. The key product of the plant are power transformers and autotransformers in 110–750 kV range with capacity exceeding 25 MVA, including three-phase execution.



SuperOx was established in 2006 by investor Andrey Vavilov for development of production technology of high-temperature superconductive second generation wires. The company has manufacturing branches in Russia and Japan.



Surgut SDPP-2 supplies electric power to the regions of West Siberia and Ural and is the largest producer of electricity in Russia and third by capacity thermal power plant in the world: total installed capacity of the power plant is 5657.1 MW. It is a branch of Unipro generating company.



Togliatti Transformer Limited is one of the largest designers and makers of electric engineering equipment in Russia and the CIS countries. As of today, the company's main business is highvoltage power transformers production.



JSC «Uralelectrotyazhmash» (UETM) is the biggest Russian developer and producer of electric power equipment for generation, transmission, distribution and consumption of energy. The company makes over 2000 items of products for 3000 customers in Russia and abroad.



Fortum JSC is a leading producer of thermal and electric energy in Ural and West Siberia. The company structure includes eight TPPs. Fortum is a part of Russia division of the Finnish state energy company Fortum corporation.



The Public listed company Federal Grid Company of the Unified energy system (FGC UES PJSC) is one of the largest public power grid companies in the world, tasked with operation and development of the Unified national (all-Russian) electric network. The company is listed as a systemic company in Russia.



Chirchik Transformer Plant JSC was founded in 1942 and for over 70 years now, has worked in machinebuilding of Uzbekistan, producing transformers and packaged transformer substations. Today, it is a leading company of electrical engineering in the Republic of Uzbekistan.



Open Joint Stock Holding Company «Electrozavod» (OJSHC Elektroavod) is the leading Russian and world-wide manufacturer of various transformer equipment being supplied for all industries including electric-power industry, metallurgy, machine building, transport, oil and gas complex, housing and utilities infrastructure.



Electroshield Samara is an advanced technology industrial company, boasting 70 years of history, and the largest domestic manufacturer 0,4–220 kV distribution equipment. This is one of the leading engineering companies comprising two design institutes, construction company, several manufacturing sites in Russia and the CIS and a well-developed regional offices network.



Energy Standard Ltd is a dynamically developing company that promotes products of the largest CIS plants on the Russian market, including products of Zaporozhtransformator. The company offers a wide range of equipment for oil, gas, chemical, ferrous and nonferrous metallurgy, rail transport and mining industries.

We appreciate our partners for any information about our companies' joint activities, which we will gladly print on the pages of the next issue of our corporate edition. We look forward to your news on this email address: n.borichev@mosizolyator.ru

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