

The way that the Institute of Electrodynamics of NAS of Ukraine passed is the path of formation and development of power and electrical engineering, and power electrical machine engineering of Ukraine, notable achievements of the scientists of the Institute, the establishment and development of schools of sciences and new directions in electrical and power engineering.

The history of the Institute of Electrodynamics of NAS of Ukraine (IED NAS of Ukraine) is associated with the creation of the Institute of Energy in 1939, the main research areas of which in the field of efficiency and reliability improvement of electrical power systems have formed the basis of scientific activities of the Institute.

In May 1947, by a decision of the Council of Ministers of the Ukrainian SSR, the Institute of Energy of AS of USSR was divided into two independent institutes: the Institute of Electrical Engineering and the Institute of Heat Power Engineering of AS of USSR. Since that time, begins the history of the Institute of Electrodynamics of NAS of Ukraine (the Institute of Electrical Engineering of AS of USSR until 1963).

Over the years, the scientific staff of the Institute was headed by leading scientists: S.O. Lebedev, the academician of AS of USSR, A.D. Nesterenko and O.M. Milyah, the corresponding members of AS of USSR. Since March 1973 and up to May 2007, the Institute of Electrodynamics of NAS of Ukraine was headed by Anatolii Kornijovych Shydlovsky. Since May 2007, the Institute of Electrodynamics of NAS of Ukraine is headed by Oleksandr Vasylovych Kyrylenko, the academician of NAS of Ukraine.

During the years of the Institute's existence there took place changes inherent for all scientific institutions: scientific personnel increase; correction of scientific directions; researches expansion and deepening, formation of new schools of sciences, that later evolved into independent institutions.

Lately the activities of the Institute are aimed at the development of fundamental and applied researches to address the issues relevant to Ukraine, such as improvement of the operational efficiency and reliability of power equipment of the power systems of Ukraine; development of scientific bases of highly efficient devices and systems of semiconductor transforming technology as the basis for the creation of energy-saving technologies; development of scientific bases of highly efficient electromechanical energy converters and controlled electric drive; development of scientific bases of energetics informatization to improve the reliability and safety of power production through the creation of new technologies of management, monitoring and diagnostics; construction of the precision measuring instruments and systems for electrical and magnetic measurements.

A number of significant scientific results were received.

Scientific foundations and means to increase energy efficiency and operational reliability of power networks of Ukraine are developed. These studies are focused primarily on solving complex issues related in particular to the implementation of measures and means, and creation of the conditions for parallel operation of the United Energy System (UES) of Ukraine with the United Energy Systems of European countries ENTSO-E (European Network of Transmission System Operators for Electricity).

The research and development of means for enhancing the capacities of UES of Ukraine were carried out taking into account the requirements of flexibility, operational safety, survivability and sustainability of interconnected power utilities as well as observation and control of electric power systems and facilities based on modern information technologies.

On the basis of the results received from scientific researches a regional system for monitoring transient modes was established as a default one for the construction of a unified system to control the modes of UES of Ukraine. The following means were developed: the means for prompt determination of the admissibility of overflows in the controlled sections of electrical network, the hardware to increase the capacity of intersections, electric power quality and reactive power compensation. It is talked of creating system power devices, so called Flexible AC Transmissions (FACT). As a part of these works, the theory and principles of the construction of semiconductor adjusters for operational stabilization of electrical energy

parameters in electrical power systems were developed. In addition, the methods of optimal selection of type, capacity and locations of FACT means installation were developed in respect to the increase of intersections capacity of power systems. New technical solutions were used by NPC "Ukrenergo" for the schemes of prospective development of UES of Ukraine.

The software to optimize the conditions with respect to the levels of voltage and reactive power flows, and also to calculate emergency and dynamic modes of the UES of Ukraine in terms of its parallel operation with power systems of ENTSO-E, was developed.

A complex of works to study magnetic and temperature fields, and thermodynamic processes in the generating equipment was carried out. Together with SE "Zavod Elektroyazhmash" new technical solutions for the design of turbogenerator stator core and outer packages of stepped forms, and new technical solutions for separate cooling of the frontal and slot parts of its windings were proposed. The received results were used in the development of technical and technological solutions with a comprehensive modernization of turbine generators of 200 and 300 MW in order to increase the overall resources of machines up to 50-60 years, and also in the creation of new types of turbine generators of Series TG 235 and 320 MW.

A completely new design of powerful generating equipment of synchronous-asynchronous type of new generation was scientifically justified, investigated and developed. It ensures the increase of active power in energy system of Ukraine while improving its reliability, flexibility and safety. These developments define the building strategy of strong power equipment for power stations of the country for the next decade. On the basis of fundamental scientific results, the ways and technical solutions of significant improvement of the reliability and operation efficiency of powerful generators were worked out together with SE "Zavod Elektroyazhmash".

The theory of analysis of quasi-stationary electric fields in dielectric media with heterogeneous inclusions of a variable space configuration was developed, and is a significant contribution to the general theory of electrical engineering. According to the results of theoretical researches, a national high-voltage cable for the voltage 110 ... 330 kV of high reliability, electrothermal stability and electro-capacity was created. These cables meet the highest international standards. Their production was started at CC "Zavod "Pivdenkabel".

The result of comprehensive researches in the field of electromechanical systems is development of the theory, principles of design and structures of magnetoelectric converters, which have the highest rates of power density (per unit volume and mass) and coefficient of efficiency among the other types of electrical machines (motors and generators). Such converters are implemented at a number of Ukrainian enterprises in autonomous power supply systems and controlled electric drive of various purposes in the military technology, on-board systems of automotive transport, electrical tools, medical equipment etc.

The theory was developed, and the method of multi-scale modeling for electromagnetic processes investigation in the electrical equipment.

Based on the results of scientific basis of the development of highly efficient semiconductor converters of electricity, the devices of power electronics were developed and put into production for energy efficient technologies, complexes for ensuring reliable operation of power generation facilities, including those with RDE "Selkom" for nuclear power plants in Ukraine, for power supplies of special purpose equipment, regulation and normalization of alternating voltage, and in collaboration with "Zaporizhzhya elektroaparatny zavod" – for the systems for frequency-controlled ac drive.

New structural and algorithmic methods for increasing the accuracy and speed of information-measuring systems for technical diagnosis and monitoring of the state of powerful electrical equipment in the energetics, transportation and many other industries were developed. These developments directly ensure the increase of reliability and safety of technical equipment. According to the results of theoretical studies, the State certification of a number of working standards of capacity and electrical power of accuracy class 0.05 and 0.02 was created and successfully conducted in Ukraine for the first time; a new software and hardware method of

self-adapting reproduction of electrical voltages, currents, frequencies and angles of phase displacement, which is the basis for creating a new generation of measuring tools with ultra-high level of accuracy, was developed and experimentally tested. Portable automated metrology facilities to verify controls of electrical power quality indices and automated calibrator of voltage and current with a working voltage range from 1mV to 500V and current from 1mA to 200A, and biosensor systems based on the principles of registration of electromechanical, adsorption and fluorescent effects were created.

The Institute devotes significant attention to the innovation activities and always takes part in competitions for innovative projects.

Since 1979 the Institute publishes the journal "Tekhnichna Elektrodynamika" ("Technical Electrodynamics"), and starting from 1999 also the collection of "Works of IED of NAS of Ukraine". The Journal is included into the international scientometric databases: SCOPUS, COMPENDEX, INDEX COPERNICUS, ELIBRARY, "RZh" VINITI RAN (Moscow, Russia). Collection of "Works of IED of NAS of Ukraine" is indexed in the "RZh" VINITI RAN (Moscow, Russia), ELIBRARY.

The Institute as a basic organization of the Technical Committee on "Management of power systems and related processes of information interaction" (TK-162), which is an analogous to the MEK TK-57, was the initiator and developer of a number of important normative documents of the national importance in the energy sector, which were harmonized with the normative documents of the EU.

Also, there is the common use instrumentation center "Research and development center of automation testing in the energy sector" that operates in the Institute.