

"Faculty of Heat and Power Engineering is the leading educational and scientific division in the system of technical higher education institutes of Ukraine in the field of nuclear and thermal power, heat engineering and thermal physics"



## INFORMATION PACKAGE

### **FACULTY OF HEAT AND POWER ENGINEERING**

**Kyiv, 2020**

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\*\*\* *The information is current as for the 2020/2021 academic year. In the next academic year, there may be minor changes in the list of specialties and educational programs/specializations.*



**Foreign Economic Activity Office**

+380 44 204 83 81

[forea@kpi.ua](mailto:forea@kpi.ua)

<http://forea.kpi.ua/>

**Faculty of Heat & Power Engineering**

+380 44 204 80 98

+380 44 204 10 34

[tef@kpi.ua](mailto:tef@kpi.ua)

<http://tef.kpi.ua/en>



# 1. COMMON DESCRIPTION AND THE STRUCTURE OF FACULTY

**Faculty of Heat and Power Engineering (FHPE)** is the leading educational and



scientific division of the system of technical higher education institutes of Ukraine in the field of nuclear and thermal power, heat engineering, and thermal physics. 125 academic groups of students on five specialties are training at the faculty. The total number of students exceeds 1600 persons. The foreign undergraduate and graduate students from developing countries: Iran, Vietnam, Tunisia, Iraq, China, India, and Turkey are

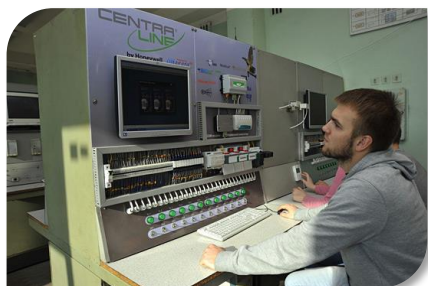
traditionally trained at the faculty.

Highly qualified teachers and educational support staff in a total of 204 persons provide the educational process. Among them: 13 professors, 60 associate professors, 25 assistant professors, 15 lecturers, and 95 persons of teaching and support staff.

## Structure

The Faculty is a large educational complex that consists of five departments and an extensive system of research units.

**1. Department of Automation of Heat & Power Engineering Processes** trains



specialists with a degree in "Automation and Computer-integrated Technologies" (educational program/specialization "Automation and Computer-Integrated Technology of Cyber-Energetic Systems").

The graduates are capable of performing the work on:

- automation and computerization of control processes in all areas of industrial production;
- development, design, and implementation of computer-integrated energy management systems for TPPs, NPPs, in institutions that use solar, wind, various types of biofuels, etc.
- management of life support processes in industrial and public buildings (artificial climate, safety, engineering systems, etc.).

Specialists from many countries were trained at the department, including citizens of Bulgaria, Germany, Poland, Cuba, Vietnam, Mongolia, China, Egypt, and Sweden.



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<http://tef.kpi.ua/en>



## 2. Department of Nuclear Power Stations and Engineering Thermal Physics



trains specialists with a degree in "Power Engineering" (educational program/ specialization "Engineering and Computer Technology of Thermal Power Systems"), in "Nuclear Power Industry" (educational program/ specializations "Nuclear Power Plants" and "Physical Protection, "Accounting and Control of Nuclear Materials"), and in "Heat Power Industry" (educational program/ specialization " Modeling and Computer Technologies in Thermal Physics").

Graduates of an educational program "Nuclear Power Plants" are focused, first of all, on the most important and perspective sphere of energetics – nuclear power engineering. They are trained to carry out the nuclear power plant control, are engaged in the modeling of neutron-physical and heat-hydraulic processes in the equipment of NPP, solve the problems of NPP reliability and safety. This activity requires thorough engineering, physicomathematical and computer skills, ability to work with modern software codes, knowledge of foreign languages.

Graduates of the department have the exclusive right to obtain a license that allows one to manage nuclear power plants. They may occupy positions from engineer to Director General of the NPP, work in other subdivisions of the NNEGC "Energoatom"; the State Inspectorate for Nuclear Regulation, in scientific and technical institutions for the support of nuclear power plants operating and nuclear safety issues in international organizations such as the IAEA, VANO et al.

Students of the educational program "Heat and Steam Power Generating Plants" study the processes of generation of heat and steam, principles of design and operation of power equipment, as well as modern efficient and clean fuel technologies. Particular attention is paid to the skills of computer design and computer software: Autocad, Compass, Mathcad, Solidworks, Ansys Fluent, 3D Max.

The gained knowledge will allow graduates to work with a variety of thermal units - energetic, industrial and household boilers, industrial furnaces, steam, and gas turbines.

Graduates work in engineering and management positions in energy companies, the power stations, in the design and scientific organizations, well-known manufacturers of power equipment such as Vaillant, Bosch, Buderus. The activity of professionals is associated with the implementation of energy-efficient technologies, the substitution of natural gas with alternative fuels, improving the efficiency of fuel consumptive equipment.

Students of the educational program "Thermal Physics" are focused on the study of heat and mass transfer processes, the development of heat exchangers, thermal



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stabilization systems in the objects of power, aerospace, transport, and construction. All this requires thorough physical and mathematical, computer and engineering training, language skills, ability to work with modern software (Compass, AutoCAD, MathCAD, ANSYS, Fluent, ESATAN). Due to the advanced scientific base of the department, students have the opportunity to take part in national and international research projects.

Graduates have real prospects of career growth of the researcher, the scientific degree of Doctor of Philosophy (Ph.D.) and Doctor of Science. They occupy leadership positions in institutions of NAS of Ukraine, design organizations, leading local and foreign energy, and innovative companies. Under the guidance of such experts' energy efficiency and development of alternative energy, activities are implemented.

### 3. Department of Automation of Designing of Energy Processes and Systems,



trains specialists in "Software Engineering" (educational program/specialization "Software Engineering of Intelligent Cyber-Physical Systems and Web Technologies"), and in "Computer Science" (educational program/specialization "Computer Monitoring and Geometric Modelling of Processes and Systems")

Students specializing in "Software Engineering" can choose one of the blocks of optional disciplines: "Software of cyber-energy systems", "Software of distributed systems and Web-technologies".

The block of optional disciplines "Software of cyber-energy systems" is focused on training of high-level specialists in the following areas: advances of the newest systems of management of complex industrial energy systems; advancing the new technologies of the development and implementation of intelligent systems; meeting the challenges of improving the performance of any system using artificial intelligence.

Students explore the features of data mining technologies, use parallel computing tools, and create adaptive real-time distributed systems.

The block of optional disciplines "Distributed Systems and Web Technologies Software" is focused on training specialists in the development and implementation of distributed software systems, whose functions are performed on several computing nodes, and the data is stored in different repositories of the network.

Special attention is given to the basic disciplines of programming, modeling of complex systems, formation and use of databases and knowledge, development of translators, mathematical modeling, IT project management, as well as more specific, inherent in this direction: parallel computing, GRID and cloud technologies, post-relational databases, computer graphics, cross-platform programming, artificial intelligence systems, disciplines for the development of server and client parts of web-applications, creation of mobile clients of web-systems.



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Students in "Computer Science" can choose one of the blocks of optional subjects: "Computer Geometric Modeling of Processes and Systems", "Computer Ecological and Economic Monitoring of Processes and Systems".

The block of optional disciplines "Computer Geometric Modeling of Processes and Systems" is focused on training IT specialists in the automation of design and modeling of objects and systems in energy engineering. Students study various aspects of computer graphics, technical design to build complex graphical objects using technical drawings, and master computer-aided design systems, CAD design, modeling of various systems, visualization of geometric information, and real-time systems.

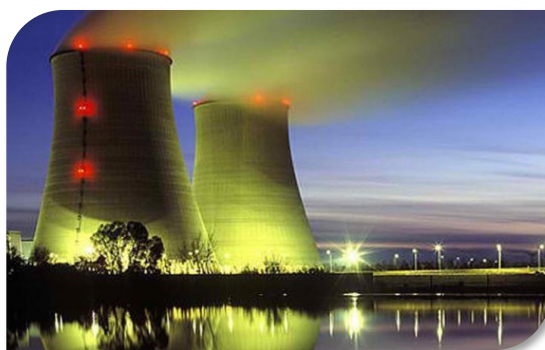
Block of optional disciplines "Computer Ecological and Economic Monitoring of Processes and Systems" is aimed at training specialists who will be able to design and implement specialized information-analytical, software-technical, intellectual, and geoinformation systems for computer ecological and economic monitoring to support decisions at various levels of sustainable development management of the country, enterprise, and business

Students gain in-depth knowledge in object-oriented analysis and design of complex distributed software systems using geoinformation tools and use them to design systems for monitoring the environmental and economic status of territorial associations.

The activity of the department is aimed at the development and widespread introduction of the latest information technologies, training of qualified specialists in the development of information, analytical and expert systems, as well as systems for automation of modeling and design of objects of different physical nature. The purpose of the training is to produce such professionals who will be able to perform almost any task that requires the use of computing and will be able to adapt to the constant changes and improvements of computer devices.

**4. Department of Theoretical and Industrial Heat Engineering** trains specialists with a degree in "Heat Power Engineering" (educational program/specialization "Industrial and Municipal Power System and Energy Saving").

Graduates of the department work on positions of chief engineers, heads of departments and directors of the energy supply of industrial and municipal enterprises, agro-firms, heads of representative offices of famous brands Bosch, Viessmann, Siemens, Buderus, Wilo, Grundfos, Vaillant, General Electric and others. Graduates work in science and research and design institutes of Ukraine, as well as in Europe, Asia, and America.



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[tef@kpi.ua](mailto:tef@kpi.ua)  
<http://tef.kpi.ua/en>



Students of the department obtain universal education among similar departments of other universities. During training, the department uses modern teaching and laboratory and stand base, innovative computerized training methods, computer lab with free Internet access, Training and Scientific Center "KPI-BOSCH» with modern energy-efficient equipment (heat pumps, solar collectors, heat generators of the contact type and with the use of biomass).

Modern technologies of simulation and research of complex heat and power processes and systems, such as Solid Works, ANSYS, Fluent, Compas, AutoCAD, MathCAD, and others allow students to carry out complex and comprehensive studies. The study of such subjects as "CAD of Power Assets", "Methods of Optimization of Thermal Power Systems", "Energy and Environmental Management", "Monitoring and Analysis of the Ecological State of Energy Assets" allows graduates to solve complex production problems.

### **5. Department of Heat and Power Units of Thermal and Nuclear Power Plants**

prepares specialists with a degree in "Heat Power Engineering" (educational program/specialization "Thermal Electric Power Stations and Plants".



Department trains heat power engineers to work on thermal power plants, in the installation and adjustment organizations, repair bases, energy associations, departments of the Ministry of Energy, design, research, and educational institutions of Ukraine.

In the educational process, the department paid a lot of attention to the use of clean and efficient energy-saving technologies for the production of electricity and thermal energy, computer technology (AutoCAD, SOLIDWORKS, ANSYS, Fluent, etc.), gas turbine and combined cycle power plant, the world experience in the field of new advanced energy technologies, on technical re-equipment, reconstruction, and modernization of energy assets.

Students of the department have the opportunity to learn and to train according to the EU ERASMUS+ program in Germany, Poland, Spain, France, as well as take part in the program of the second education.

Graduates of the department can operate, modernize, and design various power equipment for thermal and nuclear power plants.



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## 2. EDUCATIONAL PROGRAMS

**Levels of higher education.** Training of students is carried out at several levels of higher education. At the first level, (Bachelor's course, I - IV academic years) students acquire basic knowledge of physics, mathematics, mechanics, computer science, informatics, and special disciplines. During the IV year, they defend a bachelor's thesis and obtain a qualification degree Bachelor. At the second level (Master's course) students receive special training and acquire relevant practical skills in laboratory research.

**Terms of specialists training:** Bachelor (b) - 4 years; Master (m) - 2 years (standard terms of training in Bachelor's course and Master's course), Graduate course / Doctoral candidacy - 3 years (4 years by the correspondence study).

Training of specialists is carried out on the full-time and correspondence forms of education.



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## Specialties and educational programs/specializations:

**Doctor of Sciences**

**Doctor of  
Philosophy  
(Ph.D.)**

**Master's course**

**Bachelor's course**

### Information Technologies

#### Power Engineering

#### Nuclear Power Industry

#### Heat Power Industry

#### Automation and Computer-integrated Technologies

### Information Technologies

- Software Engineering of Intelligent Cyber-Physical Systems and Web Technologies
- Computer Monitoring and Geometric Modeling of Processes and Systems

### Power Engineering

- Engineering and Computer Technology of Thermal Power Systems

### Nuclear Power Industry

- Nuclear Power Plants
- Physical Protection, Accounting and Control of Nuclear Materials

### Heat Power Industry

- Modeling and Computer Technology in Thermal Physics
- Industrial and Municipal Power Systems and Energy Saving
- Thermal Power Plants

### Automation and Computer-integrated Technologies

- Automation and Computer-Integrated Technology of Cyber-Energetic Systems



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### 3. TRAINING AND LABORATORY BASE

The laboratories of the **Department of Automation of Heat and Power Engineering Processes** are provided with the most up-to-date equipment from world leaders Phoenix Contact, Unitronic, Schneider Electric, Honeywell, Siemens, Advantech, and Ukrainian companies RAUT-Automatik and Microl.

When implementing modern systems for automatic control of technological processes, an important component is the adjustment of control algorithms in the laboratory. Therefore, it is relevant to create a software system using modern programmable logic controllers for simulation the operation of automatic control of a technological object.

Advanced automation systems use sophisticated network connections between smart devices to control process equipment. The algorithms of such systems include the analysis of the state of the industrial network and the application of emergency protection in the event of emergencies. Therefore, it is important to study the configuration of modern industrial networks, programming the operation of equipment in different modes, and the application of technological protection in the presence of appropriate conditions.

These were the main tasks in the development of new laboratories:

- EDUNET International Training and Technology Laboratory.
- Honeywell Smart Home.
- Laboratory of Basic Programming and Embedded Systems.
- Laboratory of Technological Measurements and Devices
- Laboratory of Automation Systems for Intelligent Buildings
- SIEMENS Industrial Automatics Laboratory
- CISCO Network Technology Lab

**Department of Nuclear Power Stations and Engineering Thermal Physics** has a modern laboratory and technical basis for the study and general engineering disciplines. The department has two computer labs and two computer classes, equipped with modern technics. Computer classes have access to the Internet.

The department has six specialized laboratories for students' laboratory and workshop training. There is also an office for a course and diploma design with the library of the department.

The effectiveness of the learning process is enhanced by the use of the latest Internet technologies, and "E-campus system."



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The following laboratories were created to carry out the educational process at the current information level at the **Department of Automation of Designing of Energy Processes and Systems**:

- Laboratory of Geometric Modeling and Computer Graphics;
- Laboratory of distance learning tools;
- Laboratory of Computer Networks;
- Laboratory of Software for Artificial Intelligence;
- Laboratory of Mathematical Modeling.
- Laboratory of Information Technologies of Design;
- Laboratory of Computer Ecological-Economic Monitoring;
- Laboratory of Systems with Distributed Databases;
- Training and Production Workshop.

Computers are equipped with software:

- Operating system Windows, Windows Vista Business Edition, Linux Mandriva;
- Soft developers' tools Borland Developer Studio, Microsoft Visual Studio, Borland Delphi;
- Specialized software products: Microsoft SQL Server, InterBase SQL Server for Windows, Microsoft Visual FoxPro, Autodesk Design Review, AutoCad Mechanical, MathLab, MapInfo Professional.

Original means of creating and maintaining a distance learning course are introduced at the department. Works on the creation of education distance learning courses in the department's disciplines are carried out with the use of developed tools are.

Students of the **Department of Theoretical and Industrial Heat Engineering** study a range of specialized disciplines, such as: "Integrated Computer Technologies", "Mathematical Modeling and Optimization of Processes and Systems", "Sources of Heat and Heat Consumers", "Energy Saving in Heat Supply", "Using of Secondary Energy Resources", "Systems and Units for Disposal of Industrial Emissions", "Use of Alternative Energy Sources" and others.

During training, the department uses modern teaching and laboratory and stand base, innovative computerized training methods, computer lab with free Internet access, Training and Scientific Center "KPI-BOSCH» with modern energy-efficient equipment (heat pumps, solar collectors, heat generators of the contact type and with the use of biomass.

The students of the department have an opportunity for education at foreign universities for one or two years under joint double degree programs and European grants in such countries as Germany, France, Sweden, Norway, Poland, South Korea. After grad



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school, graduates have the opportunity to continue their studies in postgraduate studies, including through grants at foreign universities.

**Department of Heat and Power Units of Thermal and Nuclear Power Plants** has 7 specialized training laboratories. Also, the Department is widely used in the educational process equipment of Kyiv Heat-Electric Generating Plant № 5, Laboratory of Equipment Diagnostic and Laboratory of Metals of JSC "Kyivenergo."

Department uses its laboratory facilities and research base of leading enterprises to carry out research work. Research is conducted by the department staff, students, undergraduates, and graduate students.

Educational and Research Laboratory, including the sub-department "Problems of Burning" has the appropriate technical equipment: gas supply system with a gas pressure of 0.1 MPa, technical water supply, power supply, machine-park, air blowers with the excessive pressure.

Appropriate test equipment is used for the analysis of the research results: potentiometers, water meters, gas meters, air meters, gas analyzers. Research results are processed by computers with the appropriate software. Research on the development of a coal dust supply system with a high concentration and the corresponding burners are performed on the research base of Tripolie CHP.

## 4. RESEARCH ACTIVITY

The research activity of the Heat & Power Engineering Faculty is aimed at the solutions two major interrelated problems, namely:

- Implementation of current research, developmental and technological works for the needs of energetics, industry and social services to improve the energy efficiency of material production, increase energetic efficiency, reliability and security of power generation and consumer's equipment and heat technologies, increasing the competitiveness of products, works and services in power, thermal power and thermal engineering.
- Improving the quality of training of engineers and scientists with an appropriate combination of cutting-edge fundamental and applied scientific research and development with the educational process.

**Department of Automation of Heat and Power Engineering Processes** conducts research and design works in the following directions of automation:

- Process control systems based on modern microprocessor technology;



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[forea@kpi.ua](mailto:forea@kpi.ua)

<http://forea.kpi.ua/>

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+380 44 204 10 34

[tef@kpi.ua](mailto:tef@kpi.ua)

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- Computer simulators and their use for personnel training on management of process parameters;
- Modern technology of computer-aided design;
- Microprocessor control and regulation of energy processes and consumption of energy and resources.

According to the results of the last 5 years of scientific activity:

- 6 intellectual property rights certificates were obtained;
- 3 dissertations for the Ph.D. degree were defended;
- 7 international scientific conferences were organized;
- Two monographs and four textbooks were published.

**Department of Nuclear Power Stations and Engineering Thermal Physics** has a powerful research division. Teachers, researchers, and students jointly carried out a lot of investigations and development work in the field of conventional and nuclear energy, energy efficiency, reliability and safety of thermal and nuclear power plants, development of new high-efficiency heat exchangers, and methods of their calculation.

The department developed equipment based on heat pipes for cooling and temperature stabilization of onboard electronics of artificial satellites, the first micro-satellites of the Igor Sikorsky KPI PolyITAN, compact heat exchangers for utilization of the waste heat gas of fuel consumptive devices, new types of advanced heat transfer surfaces, which give an opportunity to significantly reduce metal consumption of energy equipment.



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At the **Department of Automation of Designing of Energy Processes and Systems** research and development work is carried out on 4 priority areas of innovation development:

- New computer tools and technologies of society informatization;
- Technologies of evaluation and protection of the environment for sustainable development of industrial areas;
- The latest technology and resource-saving technologies in energy, industry, and agriculture;
- Diagnostic tools and treatments for common diseases.

The main directions of scientific activity of the **Department of Theoretical and Industrial Heat Engineering**:

- Theoretical and experimental investigations of hydrodynamics and heat and mass transfer in two-phase closed thermosyphons; development and creation of industrial heat transfer devices;
- Development of innovative clean technologies of burning gaseous fuel in the combustion chambers of gas turbines, boilers, furnaces, contact heat generators;
- Development of new energy systems "Aquarius" type heat generating apparatus of the contact type and biofuel (wood chips, pallets, wood waste, straw, etc.), and hydrogen.

Areas of research activity of the **Department of Heat and Power Units of Thermal and Nuclear Power Plants**:

- Development, research, and placement into service delivery system of highly concentrated coal dust in power boilers;
- Development of high-performance low-emission burners for combustion of highly concentrated coal dust;
- Development of new technologies and high-performance burners for cleaner-burning gaseous fuels with reduced emissions of toxic nitrogen oxides in boilers, furnaces, combustion chambers of high-gas-turbine plants, air heaters;
- Development of technologies and burners for combustion of secondary energy resources of vegetable origin;
- Assessment of residual resource and prolongation of operation of steam turbines with a capacity of 200-800 MW exhaust their economic life.
- Diagnostics of high-temperature steam turbine components, analysis of the stress-strain state of the steam turbines of high power.
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## 5. INTERNATIONAL PROJECTS AND COLLABORATION

**The Department of Automation of Designing of Energy Processes and Systems** is actively involved in credit mobility projects in the framework of the Erasmus+ program. The scientific and educational group of the department participates in the international consortia within the framework of the applications for EEA, Norway Grants, and DIKU programs.

The foreign partners of the department: Shandong Academy of Sciences, (Institute for Development Strategy of Science and Technology, Shandong Computer Science Center, Institute of Oceanographic Instrumentation), PRC; Polytechnic Institute of Tomar, Portugal; Norwegian University of Science and Technology(Gjøvik); University of Málaga, Spain.

A Joint Sino-Ukrainian Scientific and Innovative Hydroacoustic Laboratory was established, as well as a Sino-Ukrainian Center for Engineering Innovations.

In 2019 the training of students from the Shandong Academy of Sciences has started at the postgraduate school of Igor Sikorsky KPI.

Joint scientific researches are conducted in the following areas: determination of the direction and classification of marine objects in the oceans; mathematical models of signals and interferences; computation of propagation parameters of sound waves in the marine multilayered environment; mathematical simulation of processes of the structural dynamic of correction of measuring transducers based on integral equations; STEM education; underwater networks; a comfortable environment for older people with the use the Internet of Things; data consolidation; intellectual text analysis; analysis of big data.

**The Department of Automation of Heat & Power Engineering Processes** has become a full member of the international educational network EduNet, which is created and developed by one of the world leaders-manufacturers of automation tools - the German company Phoenix Contact. Due to this, students have access to the latest training techniques for innovative equipment and can try their hand in world-class professional competitions.

In 2018 alone, the department had two winning Xplore New Automation Award 2018 student work projects:

- "Basanabar", created to save lives in an accident.
- "Smart-city garbage and logistic systems", which showed the benefits of unified information space of the city.



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The department works in several directions within the framework of international activity:

- Cooperation with foreign scientific and educational institutions;
- Cooperation with international and foreign commercial and non-profit companies and institutions.

Within the framework of work with foreign scientific and educational institutions the departments established cooperation with the following institutions:

- KTH Royal Institute of Technology in Stockholm, Sweden;
- Auckland University
- Wrocław University of Science and Technology, Poland;
- Leipzig Higher Technical School, Germany;
- Belarusian National Polytechnic University - Minsk, Belarus;
- The National Academy of Sciences of Belarus (NASB) - Minsk, Belarus;

The department participates in the Erasmus + program, under which students have the opportunity to study in foreign universities, and the scientific and pedagogical staff to undergo internships.

Departments have established close mutually beneficial relations with commercial organizations - leaders in the fields of automation, namely:

- Phoenix Contact GmbH & Co.KG, Germany - automation tools and equipment for control systems;
- Klinkmann, Finland - all levels of Automated Process Control Systems and integration into the technological process ;
- Wonderware, USA - InTouch dispatching control systems, process modeling, MES systems;
- Honeywell, USA - a world leader in automation;

The department is a member of the Association of Industrial Automation Enterprises of Ukraine, which includes numerous international companies - <https://appau.org.ua/chleny-appau>.

**The Department of Theoretical and Industrial Heat Engineering** has international agreements and contracts with the Warsaw University of Technology and the Opole Polytechnic University (Poland);- double diploma programs with the University of La Laguna (Spain), Zhejiang University of Science and Technology (Hangzhou, PRC), postgraduate scholarship double diploma program with Korea Institute of Science and Technology (Seoul).



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<http://tef.kpi.ua/en>





## 6. CONTACT INFORMATION

### 1. Faculty Dean: Doctor of Technical Sciences, Professor, Evgen M. Pysmennyi

Address: 6, Politechnichna St., Ed. Building 5, Room 315, Kyiv, 03056 Ukraine

Phones: +380 44 204 99 04, +380 44 204 80 98

e-mail: [tef@kpi.ua](mailto:tef@kpi.ua)

Official website: <http://tef.kpi.ua/>

### 2. Department of Automation of Heat and Power Engineering Processes

Acting Head of Department:

Doctor of Technical Sciences, Prof. Volodymyr V. Voloshchuk

Phone: +380 44 204 80 84

Official website: <http://atep.kpi.ua/>

### 3. Department of Nuclear Power Stations and Engineering Thermal Physics

Head of Department: Doctor of Technical Sciences, Professor, Valerii O. Tuz

Phone: +380 44 204 80 87, 204-96-23

Official website: <http://aesiitf.kpi.ua/>

### 4. Department of Automation of Designing of Energy Processes and Systems

Acting Head of Department:

Candidate of Technical Sciences, Associate Professor, Oleksanser A. Koval

Phone: +380 44 204 82 90, +38 044 204 09-85

Official website: <http://apeps.kpi.ua/>

### 5. Department of Theoretical and Industrial Heat Engineering

Head of Department:

Doctor of Technical Sciences, Professor, Gennadii B. Varlamov

Phone: +380 44 204 90 92

Official website: <http://tpt.tef.kpi.ua/>

### 6. Department of Heat and Power Units of Thermal and Nuclear Power Plants

Head of Department:

Doctor of Technical Sciences, Professor, Olga Yu. Chernousenko

Phone: +380 44 204 80 89

Official website: <http://tes.kpi.ua/>



Foreign Economic Activity Office

+380 44 204 83 81

[forea@kpi.ua](mailto:forea@kpi.ua)

<http://forea.kpi.ua/>

Faculty of Heat & Power Engineering

+380 44 204 80 98

+380 44 204 10 34

[tef@kpi.ua](mailto:tef@kpi.ua)

<http://tef.kpi.ua/en>

