

URAL ENERGY INSTITUTE – Territory of Collaboration

Vadim Silin

UrFU, Ural energy institute

- Institute **was founded in 1930** and since that time was developed to meet challenges of energy industry and was transformed from one organizational structure to another
- Almost 75% of engineers and CEOs of largest energy enterprises in the Ural region – alumnus of Ural energy institute
- Now **we are one of the biggest institutes** in Ural federal university:
 - 10 departments
 - 11 high-tech scientific and educational laboratories
 - 50 specialized utilities and testing rigs for scientific and educational purposes
 - Professional staff: 60 professors, doctors of Sciences, 200 associate professors, candidates of Sciences, 30% of them – industrial experts
 - 2000 of students (engineering programs students – 150, bachelor’s programs, full-time and part-time students – 1700, master’s programs students – 150)

Leading R&D activities

N	Activity	Academic staff	Graduate students per year
1	Modernization of electric power systems based on the modern innovations, advanced control algorithms and operation	4 doct. of sci. 12 cand. of sci.	Bach. – 60 Masters – 20
2	Creation new sources of energy, systems of renewable and nuclear energy with high efficiency	3 doct. of sci. 8 cand. of sci.	Bach. – 15 Masters – 5 Engineers – 20
3	Improving energy efficiency of industrial sector and public utilities	6 doct. of sci. 9 cand. of sci.	Bach. – 50 Masters – 20
4	Research and development in the field of "Clean Coal Technologies" of low-grade solid fuel's thermochemical conversion	4 doct. of sci. 10 cand. of sci.	Bach. – 20 Masters – 5
5	Research, development and introduction of new types of energy-efficient electric motors, including the use of nanostructured radiation-resistant insulating materials	2 doct. of sci. 7 cand. of sci.	Bach. – 60 Masters – 5

Modernization of electric power systems based on the modern innovations, advanced control algorithms and operation

- **Laboratories and testing rigs:**
 - Real-Time Digital Simulation system – digital modelling and testing of physical assets and complicated power distributed systems, DSM algorithms
 - Operative-dispatch testing rig, combined with the AMR system to create new adaptive algorithms to manage a high-voltage networks and distribution networks
 - Laboratory of 3D-modelling elements of power grid
 - Laboratory of transient processes in electrical grid
 - Laboratory of electrical assets of thermal power stations
 - Laboratory of relay protection of electrical grid



Research topics:

- Electric grid stability
- Transients processes
- Distributed generation of electric power
- Reduction of losses in electric grid
- Demand side management

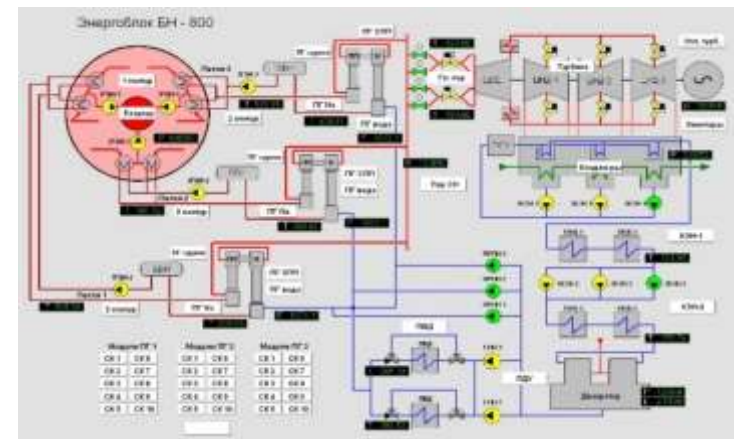
Creation new sources of energy, systems of renewable and nuclear energy with high efficiency

- **Laboratories and testing rigs:**
 - Nuclear power plant reactor segment
 - Virtual simulator of emergency situations, allowing to simulate normal, transient and emergency modes of NPP
 - Household with low energy consumption regime equipped by extended renewable energy system (wind, PV, heat pump)



Research topics:

- Renewable energy for local supply (small hydro power stations, wind farms, PV)
- Energy from agricultural residues (biogas)
- Organic Rankine Cycle
- Utilization of radioactive wastes
- Efficient, affordable, reliable and safe nuclear energy



Improving energy efficiency of industrial sector and public utilities

- **Laboratories and testing rigs:**
 - Laboratory of quality verification of heat-proof materials for housing and communal utility services
 - Laboratory of heat and mass transfer
 - Laboratory of water treatment
 - SCADA laboratory (virtual modelling trainer) of automation of municipal boiler station equipped by small-scale steam turbine
 - Municipal boiler station equipped by small-scale steam turbine



Development of this research area will create a unique approach for implementation energy and resource saving measures in the energy, industry and public utility sector, create a strategic and the methodological basis for putting into practice the concept of Sustainable Development

Research topics:

- Both economic and technical issues of improving efficiency of complex engineering systems
- Sustainable functioning of critical infrastructures
- **Management of engineering systems on Sustainable development basis**

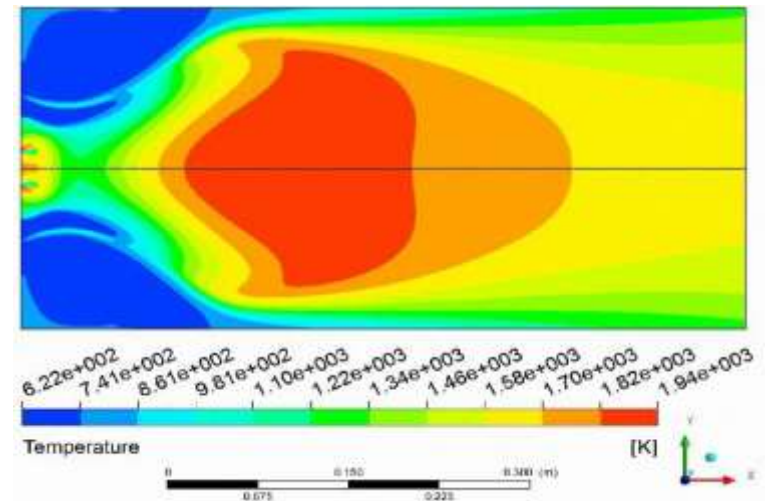
Research and development in the field of "Clean Coal Technologies" of low-grade solid fuel's thermochemical conversion

- **Laboratories and testing rigs:**
 - Synchronous Thermal Analysis TGA system
 - Lab thermochemical reactors and steam gasifiers
 - Laboratory of fuel combustion and research
 - CFD-modelling laboratory

Practical results:

- Cheap and reliable air-blown gasification technology for low-grade fuels with Net efficiency 44-45% and higher (more than 50%) in case of new gas turbines

Development of this research area will create a modern economically and environmentally high-performance system-forming solid fuel thermal power plants



Research, development and introduction of new types of energy-efficient electric motors, including the use of nanostructured radiation-resistant insulating materials

- **Laboratories and testing rigs:**
 - Laboratory of Electromechanics
 - Laboratory of industrial electrical assets
 - Laboratory of variable frequency drives
- **Development of this research area will create**
 - new types of electric motors for the energy, transport, industry and for the special conditions of radioactive applications
 - Recuperative systems with supercapacitors for transport and lifts



Bachelors (4 years)

- Heat engineering and thermotechnics
- Power and electrical engineering
- Renewable energy
- Turbines and propulsions
- Applied mathematics

Engineers (5.5 years)

- Nuclear power plants: designing, exploitation, engineering
- Active collaboration in educational field within "Energy" branch of Shanghai cooperation organization University
- Cooperation with universities and organizations of Germany, Italy, Sweden, Poland, China, Mongolia, Kazakhstan, Vietnam, Tajikistan, Uzbekistan
- Programs of double diplomas with Universities in Czech Republic and Egypt



2 years, full-time programs

1. Industrial heat engineering
2. Energy effective technologies of heat and power production
3. Alternative and renewable energy sources
4. Actual problems of technological process of production and transmission of electricity
5. Design and operation of electric power systems
6. Electrical power systems, networks, modes, stability, reliability
7. Fundamentals of electro mechanic
8. Electric drive and automation of industrial installations and technological complexes
9. Electrical equipment and automation of robotic systems
10. High voltage electrical equipment and installations
11. Electrotechnological installations with systems of power and control
12. Power supply and electrical equipment of industrial enterprises
13. Turbines and propulsions
14. Applied mathematics

Ways of collaboration

- Collaborative R&D
- Training of students, undergraduates, graduate students, staff
- Joint publication of articles, monographs
- The creation of joint educational programs, electronic educational resources, implementation of joint training programs
- Organization of joint conferences, exhibitions, meetings

