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**Integrating education with consumer behaviour relevant to energy efficiency and climate change at the Universities of Russia, Sri Lanka and Bangladesh (BECK)**

**Partner report on current state of higher education and its relationship with consumers' behaviour on energy efficiency and climate change**

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## 1 INTRODUCTION

The purpose of this series of country reports is to obtain general philosophical, pedagogical and practical understanding on the status of higher education and its impact on consumer behaviour relevant to energy efficiency and climate change in BECK partner and European partner countries. It will also provide a basis for understanding and evaluating the capabilities of partner institutions on integrated education for energy efficiency and climate change. The results of these reports will inform a capacity building framework, which will form the basis for development of modules on energy efficiency and climate change during the BECK project.

The reporting approach is based on the Capacity Needs Assessment Methodology (CAPNAM) proposed by the United Nations (2013).

The report includes chapters on the following:

- Methodology. This section describes the methodological approach used to collect and analyze the data that informs the findings presented in this report.
- Context. Provides an overview of the regulatory, socio-political, and cultural factors that shape policy on the consumer behavior relevant to energy efficiency and climate change in the country in general, and education in particular.
- Scope and coverage of education policies on consumer behavior relevant to energy efficiency and climate change by the Higher Education Institution (HEI). Examines the illustrative policy and planning issues relevant to integrated education on consumer behavior relevant to energy efficiency and climate change.
- Description of capacity types. Evaluates the existing state of capacities of HEI in the field of integrated education on consumer behavior relevant to energy efficiency and climate change. As defined by the CAPNAM analytical framework, the four types of categories are institutional, organizational, individual, and the knowledge base.

The content of this report is related to the BECK Project and reflects only the author's view. The National Agency and the Commission are not responsible for any use that may be made of the information it contains.



## 2 Methodology

Different methodological approaches were used to collect and analyze data for this report. However, the main data was obtained from surveys conducted (institution level) and analysis of regulatory documents and literature (country level).

The method used is based on identification of existing key capacities and additional capacities to be developed to reach objectives. By means of desired capacities analysis against existing capacities an understanding of capacity assets and needs was achieved. This was used as input for formulating a capacity development response that addressed institutional capacities that could be strengthened and existing capacities that are already strong and can be optimized.

1. The data about the institution capacities was obtained by means of a full-scale survey. No less than 95 % of academic staff and students took part in the survey. The data obtained by means of the survey is mainly included in the chapter 5 of this report. The method used to develop the questionnaire was based on several fundamental principles:

- 1) Only the most important questions are included
- 2) Questions are of maximum shortness and simplicity
- 3) Questions are asked in a direct way
- 4) Only one question is asked at a time
- 5) No leading or biased questions are included
- 6) Response scales are used whenever possible
- 7) Minimum grids or matrices are used for responses
- 8) Yes/no questions are rephrased if possible

2. Regulatory documents and literature analysis was conducted to reveal current state and modern trends in consumer behavior relevant to energy efficiency and climate change in Russian Federation. All documents were analyzed based on standard 5-step methodology: review of the objective, organization of the information, decision how to analyze information, analysis of the information, integration of the information.

The core documents used are given in the text of this report as references. The list of these documents with reference numbers is given below:

- 1) Report of the United Nations Development Program on Human Development Statistics. Note by the Secretary General. - 6th UN session, March 3-6, 2015
- 2) Framework Convention on Climate Change / UN. 21st session. - Paris November 30 - December 11, 2015.
- 3) Energy revolution: The prospect of the formation of the system of energy security of the Russian Federation. - Greenpeace. -2009.-P.44.
- 4) Federal Law of 23.11.2009 N 261-ФЗ (as amended on 12/27/2018) "On energy saving and on increasing energy efficiency and on introducing amendments to certain legislative acts of the Russian Federation" (as amended and added, effective from 01/16/2019).
- 5) The state program of the Russian Federation "Energy Efficiency and Energy Development". Approved by the Government of the Russian Federation on April 15, 2014, No. 321.
- 6) Shchelokov Y.M. Energy Saving of Russia: Issues of Efficiency and Policy / Energy Saving. -2017, №.-C. 28-32.
- 7) Towards sustainable development. 2009-2011, Institute for Sustainable Development. – Analytical review. sustainabledevelopment.ru upload / File. - p.46



- 8) Federal State Educational Standard of Higher Education -13.03.02 Power engineering and electrical engineering. Approved by order of the Ministry of Education and Science of the Russian Federation of February 28, 2018, No. 144.
- 9) Federal State Educational Standard of Higher Education - Master degree in 13.03.02 Power engineering and electrical engineering. Approved by order of the Ministry of Education and Science of the Russian Federation of February 28, 2018, No. 147.
- 10) Federal state educational standard of higher education 13.06.01 Electrical and heat engineering (Level of training of highly qualified personnel). Approved by order of the Ministry of Education and Science of the Russian Federation of July 30, 2014, No. 878.
- 11) Gasho E.G. The solution to the problem of energy preservation in Russia. Some results and myths / Energy saving. - 2017, № 2.-C. 36-41.
- 12) Sedash T.N. Foreign experience of energy saving and increase of energy efficiency in housing and public utilities / Vestnik RUDN, Economy series, 2013, №2.-C.61-68
- 13) Beley V.F., Zadorozhny A.O. Russia's Wind Energy: Analysis of the State and Development Prospects // M. - Energy: economy, technology, ecology.- №7. P.19-29. and no. 8. Pp. 2-15.
- 14) Beley V.F., Kharitonov M.S. Bio and Electromagnetic Compatibility of Ship Lighting Systems Based on LED Light Sources, Marine Intelligent Technologies, 2017, No. 3 (37), V.1. C.67-74. (Web of Science)
- 15) Beley V.F., Zadorozhny A.O. Sea-based wind parks: the latest technology / Marine Intelligent Technology, 2017, No. 4 (38), V.2. Pp.88-92. (Web of Science).
- 16) Beley V.F., Gorbатов D.S. Improving the reliability of power supply facilities of the marine industry and the Kaliningrad region / Marine Intellectual Technology, 2017, No. 4 (38), T.2. P.83-87. (Web of Science).



### 3 CONTEXT

*This section provides an overview of the regulatory, socio-political, and cultural factors that shape policy on the consumer behavior relevant to energy efficiency and climate change in the country in general, and the education in particular. Please answer following questions.*

#### 3.1 Socio-political and cultural context

Climatologists warn that if the atmosphere average temperature rises by more than 2 ° C compared to the pre-industrial level, global warming will be out of control and the economic, social, political and cultural consequences of climate change will be difficultly imaginable [1-2]. To prevent this process, natural resources consumption system should be refashioned first using new technologies for the production of electricity based on renewable energy sources and energy consumption models. The Russian Federation has one of the highest potentials of renewable energy sources in the world. The country has everything necessary to increase energy efficiency and reduce the cost of clean energy production [3]. Federal Law N 261-FL, 23.11.2009 govern the relations on energy efficiency and energy saving in the Russian Federation [4]. The purpose of the Federal Law is to create legal, economic and organizational basis for promoting energy saving and energy efficiency. The behavior of consumers related to energy efficiency and climate change in more detail is considered in the following subprograms: “Energy Saving and Energy Efficiency” and “Development of Renewable Energy Sources” of the State Program of the Russian Federation “Energy Efficiency and Energy Development” [5]. However, there is no document similar to the EU Directive (2006/32 / EC) “On the efficiency of energy end-use and energy services” in Russia [6].

Considering this [6,7], we can distinguish the following socio-political and cultural provisions, which can provide a basis for planning educational policies in the area of consumer behavior related to energy efficiency and climate change:

- 1) the strategy of ecological culture development among Russian Federation population to ensure the sustainable development of the country;
- 2) sustainable environmental management as the way to solving acute economic and socio-political problems;
- 3) ethics in energy efficiency issues: rejection of corruption, voluntary energy audit, public standards;
- 4) energy saving culture priority for sustainable development.

#### 3.2 Status of education

There is a significant lack of the information and materials on consumer behavior related to energy efficiency and climate change in the Russian state educational standards in the following areas: “Electroenergy and Electrical Engineering”, levels of bachelor and master [8,9] and “Electro - and heat engineering (Level of training of highly qualified staff)” [10] . The problem of energy efficiency for Russia is extremely relevant, not only at the stage of energy consumption, but also at the stages of its production and transmission. According to the energy efficiency rating, the Russian economy is on the 132-d place from 142 countries of the world. The energy intensity of Russia GDP is twice as high as the world average [6]. At the same time, there are a number of regions and industries in Russia where energy efficiency issues are at the level of world indicators [11]. In the curricula



developed in universities in Russia, including ours, based on state educational standards there are modules that provide the consumer behavior related to energy efficiency and climate change.

### 3.3 Funding

Currently energy in Russia is one of the priorities for the development of the Russian economy. The Ministry of Education and Science of the Russian Federation annually on a budgetary basis increases the enrollment of students in the following fields: “Electric Power Engineering and Electrical Engineering”, bachelor and master levels, and “Electrical and heat engineering (Level of highly qualified personnel)”. With the support from the regional Government and duly filled application university receives the requested budget places and the corresponding funding. This allows the university to carry out integrated education in the field of consumer behavior related to energy efficiency and climate change.

### 3.4 Educational needs

Taking into account the works [6, 7, 12], it is possible to show the following needs for integrated education in the field of consumer behavior related to energy efficiency and climate change at the Russian level.

- 1) Creation of an information and educational system in the field of energy saving, which will ensure a systematic approach to the implementation of the concept of energy saving.
- 2) The need to introduce the course "Fundamentals of energy conservation" in all higher and secondary specialized educational institutions.
- 3) The introduction of energy efficiency standards, mandatory building codes and regulations, planned indicators associated with the use of highly efficient energy-saving and environmentally friendly technologies for the consumer.
- 4) Development of distributed energy and the use of renewable energy sources, especially for the regions of the Far North, Siberia and the Far East, which do not have centralized power supply.
- 5) Interconnection of energy efficiency and climate change for the energy consumer.

### 3.5 Educational gaps

- 1) Low level of population awareness that energy saving is a real means of solving a wide range of social, economic and environmental problems for the consumer.
- 2) The lack of qualified personnel in the policies related to energy saving and energy efficiency, climate change, renewable energy sources.
- 3) The lack of incentive mechanisms for consumers related to energy efficiency and climate change, the use of high-efficiency energy-saving technologies and renewable energy sources.
- 4) The concept of the World Energy Council (WEC) proposed 10 political actions to achieve three energy goals: accessibility, availability and acceptability of energy, fundamental for ensuring political stability throughout the world, for energy business strategy and the world achieving a sustainable future [6]. This concept could be adopted in Russia as a basis for consumer related policy on energy efficiency and climate change.
- 5) The unsatisfactory state of the fuel control and accounting systems and energy consumption.



## **4 POLICIES RELEVANT TO HIGHER EDUCATION, AND THEIR RELATIONSHIP WITH CONSUMER BEHAVIOUR ON ENERGY EFFICIENCY AND CLIMATE CHANGE**

*This section examines the illustrative policy and planning issues relevant to integrated education on consumer behaviour relevant to energy efficiency and climate change. Please answer following questions.*

### **4.1 Policy and planning**

The university has the following courses in full: "Electric Power Engineering and Electrical Engineering" levels of bachelor and master programs; "Electric and heat engineering (PhD level)". Bachelor course "Power system and heat engineering" is also available. Currently, we have prepared new master course "Thermal Engineering and Heating Engineering"; it is being approved. The university has state accreditation in the integrated group of specialties (UGSN) 13.00.00 "Electrical and Thermal Power Engineering" therefore we actively participate in the activities of the federal UMO in the system of higher education in this field. Based on state educational standards and exemplary educational programs, the university's curriculum provides modules reflecting consumer behavior related to energy efficiency and climate change. Teaching staff of the University is actively involved in conducting research in the energy sector: the use of renewable energy sources, ensuring the quality of electricity and energy saving in power supply systems, the introduction of digital technologies in the energy sector [13-16]. In the framework of these scientific studies in the electrical engineering direction, final diploma works are carried out by students.

### **4.2 Gaps in policy and planning**

The following policy issues are not currently being handled by the HEI but should be considered:

- 1) Creation of department branches at the leading organizations and enterprises of the Kaliningrad region energy industry with the focus on consumer energy efficiency.
- 2) Organization of the step by step implementation of integrated education of bachelors, masters and doctors of science on the problem of consumer behavior related to energy efficiency and climate change as part of the educational process.
- 3) Involvement of students in course projects and final qualification works related to the end - consumer energy efficiency and climate change.
- 4) Organization of classes for advanced training conducted by the university for energy specialists, on the behavior and role of the consumer in problems solving related to energy efficiency and climate change.





## 5 CAPACITY TYPES

*This section aims at assessment of the existing state of capacities in the HEI for integrated education on consumer behaviour relevant to energy efficiency and climate change. As defined by the CAPNAM analytical framework, the four types of categories are institutional, organizational, individual, and the knowledge base.*

### 5.1 Institutional capacities

*This part describes the institutional capacities at HEI level. Please answer following questions.*

1. Please provide brief presentation of the HEI.

Having been founded on the basis of Moscow Technical Institute for the Fishery Industry, Kaliningrad State Technical University (KSTU) is justly considered as the beginning of Russian higher fishery education and a range of scientific schools in navigation, commercial fishery, and progressive technologies of food production. At present, it develops as a multi-disciplinary institution considering the demands and the economic potential of the Region, maintaining traditions of high quality specialist training for the fishery industry.

Students are trained in 42 higher educational courses at various levels, namely, Bachelor, Professional Diploma, Master, post-graduate (Kandidat Nauk) and doctorate (Doktor Nauk) Degrees; professionals are offered various upgrading courses. 600 teachers and researchers, including 75 professors holding the Doktor Nauk Degree, 80 academicians and corresponding members of international and public Russian Academies of Science form the faculty of the University. 28 scientists are awarded titles of honoured workers of science, Russian higher education, branches of science, and the fishery industry.

Scientific research is traditionally undertaken in many areas being the most important for the modern navigation, fisheries and seafood processing, power engineering, construction, production automation and control, information technology, natural science, nano-technology, etc. The University founded effectively working schools in ichthyology, commercial fishery, ship-building and repair, automation of production and control, technique and technology of raw materials processing. There are 12 research laboratories and scientific centres, four of them being of the applied character. Four dissertation councils work at the University.

Recently, intensification of scientific work has involved the University into 25 federal scientific programmes, as well as in TEMPUS and TACIS projects. Regional representatives of public professional Academies of Science applied Centre for new Information Technologies, Research Institute for Maritime Engineering Service, Institute of Ecology and Sustainable Development successfully operate on the University basis.

International co-operation of the University with foreign educational and research organizations is constantly expanding, with the Baltic Sea region in particular.

Developing progressively, Kaliningrad State Technical University looks ahead with confidence.

2. Please describe general model of studies according to different levels (bachelor, master, PhD).

Bachelor Degree – 4-year studies

Master Degree – 6-year studies



Specialist Diploma – 5-year studies

Postgraduate education – 4-year studies

All educational programs include compulsory and choice-compulsory courses. All programs are developed by the university in accordance with Federal Education Standards. Programs provide development of multipurpose, general professional and professional competences and skills. Every year of bachelor program is followed by lumped practice. Master and postgraduate programs have both lumped and distributed practice.

3. Please provide key facts and figures about the HEI:

3.1. Number of students: ~ 12 000

3.2. Number of academic staff: 840

3.3. Student/Academic staff ratio: ~14

3.4. Number of Faculties (please specify): 15

- Faculty of Bioresources and Nature Management
- Commercial Fishery Faculty
- Mechanics and Technology Faculty
- Faculty of Shipbuilding and Power Engineering
- Civil Engineering Faculty
- Faculty of Production Automation and Control
- Institute of Management, Economics and Entrepreneurship
- The Humanities Faculty
- Fundamental Training Faculty
- Professional Upgrading Faculty
- Fundamental Training Division for Foreign Students
- Faculty of Transport
- Faculty of Navigation
- Marine Engineering Faculty
- Radiotechnical Faculty

3.5. Number of graduates: ~ 20 000

3.6. Number of study programmes: 124

3.7. Number of international academic partners: 87

3.8. International rankings of the HEI (if any): n/a

4. Please describe main education and research areas of the HEI.

**Department of Ichthyology and Ecology** offers a number of courses dealing with hydrocoles habitats, their biology, rational use, catch control and environmental protection. The Department successfully co-operates with universities and research centers in Germany, Great Britain, Poland, Finland, and others. Members of the Department often participate in TEMPUS and TACIS international projects. Research activity of the Department is known well beyond Russia. Since 2004 Institute of Ecology and Sustainable Development has been functioning in the Department.



**Department of Aquaculture** trains specialists in fish stock natural reproduction, pond fish farming, breeding and culture of marketable fish, culture of sea fish, mollusks, crayfish and sea plants, fish genetics and selection. The major achievement of the Department – breeding of sturgeons, vimbas, pike and tench in the Kaliningrad region.

**Department of Ichthyopathology and Hydrobiology** trains students in the field of hydrobiology, water toxicology, fish diseases and physiology. Graduates work in the following areas: fauna of oceans, seas and inland waters, environmental protection, fish and invertebrate animals breeding. Since 2009 Research Laboratory for Ichthyopathology has been successfully functioning in the Department.

**Department of Agricultural Production** trains specialists in the field of production organization, storage and processing of agricultural products and crops. Students have the opportunity to undertake an internship in foreign commercial farm units. There is Research Centre for Biology and Plant Biotechnology and International Horticulture Consultation Centre in the Department. Kaliningrad agricultural producers use their findings.

**Department of Zoological Engineering** trains specialists in live-stock breeding. It has partner relationships with the leading Kaliningrad enterprises and research institutions in Germany, Norway, Poland, Belarus and Lithuania. Students have the opportunity to undertake an internship in foreign commercial farm units. At present the Department is involved into the international project on dairy-stock farming in the Kaliningrad region.

**Department of Soil Science and Agroecology** is the youngest among the departments. Since 2004 it has been training students in agrochemistry, agroecology and soil science. Students have the opportunity to undertake an internship in foreign commercial farm units. Members of the Department are proud of their international relations with the universities from USA to Kazakhstan.

**Department of Food Products Technology** was historically one of the first departments of the University. It gives the graduate an opportunity to work at any food processing enterprise in capacity of qualified food engineers. So far, the Department has graduated over 5 000 students. Almost every graduate finds employment within the specialty. Apart from all mentioned the Department carries out active research work using extensive research laboratory.

**Department of Food and Refrigerating Machinery** trains specialists to work in design bureaus, research institutions, industrial enterprises in the capacities from senior machine engineers to chief engineers and directors of small enterprises. Postgraduate students can also take teaching positions in higher educational institutions. Year over year this Department brings fame to KSTU by inventions and patent work. Two small innovative enterprises were established by common efforts of its staff.

**Department of Theory of Machines, Mechanisms and Machine Parts** provides a glimpse of modern engineering systems basics in terms of their structure, design baselines and principles. The Department offers overall engineering training of future technicians- engineers for 14 university occupations. Educational process is closely connected with research. There are several research laboratories available.

**Department of Engineering Graphics** offers such general professional courses as Descriptive Geometry, Machine Drawing, Computer Graphics. Knowledge obtained within this Department is necessary for future professional activity and aids in studying other disciplines.

Since 2004 **Department of Food Biotechnology** has been training specialists (engineers) in “Food biotechnology”. The Department also holds two master’s programs: “New food products for sensible and complete nutrition” and “Food of animal origin biotechnology”. All the graduates find employment within the specialty. The Department is equipped with advanced laboratories and carries out research in the framework of government programs and using grants. It has established stable international relationships with the universities of Europe and Latin America.



**The Shipbuilding Department** trains marine engineers in Shipbuilding. Graduates are qualified to design vessels, to plan, organize and control the process of shipbuilding and ship repair. The Department also carries out significant research in their extensive facilities including small and big towing tanks, flow channel, laboratories for ship statistics, welding and training facilities in the rural settlement Rybachiy on Curonian Spit.

**Department of Structural Mechanics of Ships and Strength of Materials** (non-graduating) also trains marine engineers in Shipbuilding and carries out research work. Members of the Department study technical evaluation of the fleet, reducing damage rate of a hull, upgrading computation methods for exhausted and damaged hulls.

**Department of Shipboard Power Plants and Thermal Power** trains engineers in Operation of Shipboard Power Plants and Thermal Power Stations. Graduates of this Department operate, repair, test and adjust thermal and power equipment of thermal power stations and shipboard power plants as well as heat and energy supply systems for cities. The Department has extensive laboratory facilities, carries out research work in the areas connected with thermal energy, stationary energy as well as energy balance and energy safety of the region.

**Department of Electrical Equipment of Ships and Electrical Power Engineering.** Graduates of the Department are involved in the operation of main and auxiliary equipment of power stations, electrical networks and systems; they can deal with equipment assembling and adjustment at power industry enterprises. They can also work as marine electrical equipment engineers on seagoing and river vessels and ship repair shops. Research is carried out in energy saving, quality of electrical energy, safety of electrical equipment and windpower engineering.

**Department of Heat and Gas Supply and Ventilation** offers training in the field of development of operation of heat systems, ventilation, heat and gas supply, air conditioning in individual buildings and structures; solving environmental problems, heat saving and using alternative sources of energy. Active research work is carried out in the field of power saving in heat, ventilation and air conditioning systems. There are modern facilities and equipment for laboratory-based work.

**Department of Civil Engineering** graduates deal with calculation and designing of bearing and enclosing structures, control of the construction and assembly works quality, development of construction and complex mechanization projects. They can work at construction sites, design organizations and companies, research institutions. Large research activity is being carried out on steel concrete characteristics.

**Department of Production Automation** trains specialists in Automated Technological Processes and Production. The Laboratories of the Department are well equipped with automation devices and units, test benches and simulators. Over 100 inventions with author's certificates were created on the research findings of the Department. A large number of course books and study materials were produced by the Department members and graduates sought in many industries.

**Department of Control Systems and Computer Engineering** awards diplomas in Information Technology with a possibility to specialize in Computing Machinery and Applied Information Technology. Graduates work in computer firms, in information departments of large manufacturing enterprises, trading companies, banks, service centers. The Department has well-equipped laboratories with PCs and peripherals necessary for research and development of expert systems and local networks. Stable partner relationships are established with Satakunta University of Applied Sciences (Finland).

**Department of Automated Machine Building** trains specialists in Machine Building Technology, Renovation of Material Production in Machine Building and Machine Building. Engineers of these specialties deal with high-performance automated machine building processes. Researchers of the Department work on elaboration of machine parts, cutting tools strengthening and technology of amber processing. The Department has well-equipped laboratory facilities.



**Department of Enterprise Management** is the oldest economic department in the University. It trains specialists in “Management (Production Management)” in all modes of study. The Department also offers master’s and postgraduate programs. Members of the Department carry out active research work in the economical problems of the Kaliningrad region and abroad.

**Department of Economics and Entrepreneurship** trains bachelors in “Economics of Enterprises and Organizations” and “Project Administration”. There are master’s and postgraduate programs. Since 2006 there is further education program “Master of Business Administration” (MBA). Main research area is economy development problems in the Kaliningrad region.

**Department of Economic Theory** trains students in general professional disciplines, that give background knowledge in economic theory, global economy and institutional economics. Research work of recent years is connected with complex fiscal topic “Modern science for perfection of economic disciplines teaching”. The Department offers master’s degree program.

**Department of Accounting, Analysis and Audit** trains bachelors knowledgeable of accounting in our country and abroad, analysis of economic activity, financial and tax activity, auditing and possessing all the necessary tools in market relations formation. There are master’s and postgraduate programs, a system of continuing education, a verification system and a career development system for academic staff. Research work is carried out on upgrading accounting, analysis and auditing in the enterprises of the Kaliningrad region.

**Department of Finances and Crediting** trains bachelors in “Economics”. Offers master’s and postgraduate programs. Since 2009 it has trained over 1000 specialists ready to take senior positions in the banking and financial industry, in government agencies and municipalities, and to master new trends in economy and management. Research is carried out in problems of financial and credit relations.

**Department of Business** was established in 2012, coming from the Department of Economics and Entrepreneurship. Trains bachelors in “Business (Commerce)”. Offers master’s and postgraduate programs. Members of the Department carry out researches in logical charts of fishery enterprises, competitiveness of commercial networks in the Kaliningrad region market.

In 2011 Innovation Activity Office was opened within the University. Its mission is to help the University staff and students who already have research and development of a project and are planning to promote them. The University staff facilitate formation of action groups which in the future become the backbone for creation of small innovative enterprises. Innovation Activity Office deals with attracting foreign, federal, public and private investments by engagement of the University specialists and research teams into the sci-tech programs, grants and commercial agreements. The Office coordinates innovation activities of separate divisions and similar to them, research laboratories as well as divisions of research structure.

#### **Small Innovative Enterprises in KSTU**

In 2012 six small innovative enterprises were built up in the fields of biotechnology, IT, mechatronics and robotics, fish industry, production and control automation, energy-efficient technology. These enterprises enable the University to commercialize scientific research results, the scientists to participate in grants, raise funds, develop scientific ideas in order to meet the requirement of the market, to reap the harvest of the intellectual labour after implementation of innovative solutions into the economy and to get significant tax advantages upon receipt of subsidies.

#### **Technological cluster of KSTU**

Today KSTU has its own Technological cluster. It is an area of innovation activities, where through well-developed infrastructure and rendering of necessary services future specialists cooperate with companies of technology sector. As on December 2012, KSTU technological cluster includes more





than 20 residents. The Cluster's work is financed at the expenses of its own activity as well as by investors and sponsors.

### **Students design bureau**

It is an area of innovation activities where through well-developed infrastructure and rendering of necessary services future specialists cooperate with companies of technology sector. In the course of their academic activity the Bureau qualifies specialists and postgraduate students for practical work in the companies dealing with science-intensive products. It is also a source of skilled personnel for technological cluster.

### **Research**

KSTU Scientific Research Office regularly monitors research activities and every year determined priority research areas for the University academic staff. Today these are the following:

#### **Aquaculture and aquatic biological resources management:**

In the framework of this area Department of Aquaculture (under the direction of prof. G.Serpunin) and Kaliningrad International Centre of Aquaculture (under the direction of associate professor E.Khrustalev) carry out researches in the field of biological development basis of aquaculture in the Kaliningrad region and development of industrial methods in aquaculture. Members of Ichthyology and Ecology Department together with research workers from Institute of Ecology and Sustainable Development (Research supervisor- prof. S.Shibaev) conduct quantification researches of hydrologic systems to develop references for improved usage of water resources.

#### **Methods and technology of food raw material processing. Mechatronics:**

Recently Department of Food and Refrigerating machinery (under the direction of prof. U. Fatykhov) has successfully carried out researches and designed mechatronic complex for batching food raw material. Intellectual property of the Department members provided the basis for creation of the small innovative enterprise, which in 2012 received a grant in the "START" program of FASIE( Foundation for Assistance to Small Innovative Enterprises in Science and Technology) and was the winner of the regional competition.

#### **Rational nature management:**

Members of the Research Centre for Municipal Improvements and Waste Management (research supervisor - prof. A.Ivanov) conduct researches in integrated study of technological and business problems in waste management. In the framework of this area Department of Water Resources and Water Management (under the direction of prof. V. Naumov and prof. N.Velikanov) carries out research aimed at developing the guidance in assessment of the impact of water disposal to the water resources quality.

**Food biotechnology:** Department of Food Biotechnology and Research Laboratory of Biotechnology (under the direction of prof. O.Mezenova) carry out research on development of functional food biotechnology out of fish processed raw material. Members of the Department (under the direction of associate professor I. Titova) study the impact of different chemicals on the fish, meat and dairy raw material quality and develop technologies for food treatment upgrading.

#### **Power engineering and Power consumption:**

Members and post-graduate students of Department of Electrical Equipment of Ships and Electrical Power Engineering (under the direction of prof. V. Belei) carry out research on fundamentals of functioning of wind turbines in the electrical systems and work out technologies for electrical power quality assurance of electro-technical complexes and systems; and under the scientific supervision of associate professor I. Kazhekin carry out research on the refinement of protective neutral grounding for electrical power systems of fishing vessels. Apart from that, Department of Food and Refrigerating Machines(under the direction of prof. U. Fatykhov and associate professor A. Suslov)



conduct research on power saving in production processes of agro-industry with the use of heat pump plants.

**Nanotechnologies:**

Members of Research Laboratory for Micro- and Nanotechnologies have been conducting fundamental research in micro- and nanotechnologies, materials-laser interaction for more than 10 years. Today members of the Laboratory carry out experimental research and development of adsorptive- luminescent sensors of biological objects abnormality with the use of both organic and nonorganic nanoporous sorbents (under the direction of the head of Innovation Activity Office I.Samusev).

**Machine building and shipbuilding:**

At this priority area research is being carried out on the vibration behavior of constructions and facilities. These investigations are being conducted by members of the Research Centre for Vibration Behavior of Constructions and Facilities under the direction of prof. S.Diatchenko. Department of Theory of Machines, Mechanisms and Machine parts (under the direction of associate professor S. Fedorov) carry out the research on engineering method of assessing and selecting friction coefficient and application of functional manipulators of food machines. Department of Electrical Equipment of Ships and Heat Power Engineering (supervisor- associate professor A.Minko) carry out research on avoidance of accidents in marine diesels caused by uncontrolled thermal overload. Department of Automatic Machine-building (under the supervision of associate prof. M. Leschinskii) has the region's most authoritative laboratory for technical equipment expertise.

**Agro-industrial complex efficiency upgrading:**

Department of Agriculture together with Research Centre for Biology and Plant Biotechnology (under the direction of prof. E. Ronzhina) carry out research work in this area. It is devoted to innovative cultivating technologies of nontraditional for the region crops.

**Technosphere safety:**

In the region's most authoritative laboratory of Life Safety Department (under the supervision of prof. V. Minko) research is being carried out on interbranch rules for labour safety in fish rearing for sale within inland water bodies.

**Economy and management in fishery industry:**

Institute of Management, Economics and Entrepreneurship conduct research on integrated study of fishery industry development problems, including such important aspects as fishery enterprises functioning amidst Russian's annexion to WTO ( prof. V. Teplitckii), financial backing of fishery industry (prof. A. Mnaticanian); and formation of logistical systems within fishery industry ( prof. V. Murov).

5. Is there any strategic priorities given to integrated education on consumer behaviour relevant to energy efficiency and climate change at HEI level? Please specify.

At present, the energy systems of the Kaliningrad Region and the Baltic countries operate as part of the IPS / UPS energy pool. In 2025, the energy systems of the Baltic countries plan to secede from the IPS / UPS energy interconnection and to connect to synchronous operation as part of the UCTE West European Energy Interconnection. At the same time, the power system of the Kaliningrad region will go into autonomous mode of operation. Therefore, the development of energy in the region is a strategic priority. To ensure this strategic priority, including in the field of consumer behavior related to energy efficiency and climate change, we conduct training of bachelors, masters and candidates of sciences in the energy profile at an institution of higher education. It should be noted that Kaliningrad State Technical University is the leading university in the Kaliningrad region, providing training in this area.



6. What are the needs at HEI in integrated education on consumer behaviour relevant to energy efficiency and climate change (please list up to five major needs):

- 1) Development of the educational system on the basis of the university in the field of energy saving, which will ensure a systematic approach to the implementation of the energy saving concept.
- 2) The need for some modules such as "Theory and Practice of Engineering Solution" or "Organization and Methodology of Scientific Research" in the scope of "Electric Power and Electrical Engineering" master degree level. The development of this module will allow the graduate to solve engineering and scientific problems in the energy sector, including in the field of consumer behavior related to energy efficiency and climate change. Module "The newest technologies of power production, transfer and usage" in the direction of "Electrical - and heat engineering (Level of training of highly qualified personnel)".
- 3) The use of energy efficiency standards, mandatory building codes and regulations, planned indicators related to the use of highly efficient energy-saving and environmentally friendly technologies for the consumer in training courses in the following directions: "Power and Electrical Engineering", bachelor and master levels and "Electro- and heat engineering" (Level of training of highly qualified personnel).
- 4) The need to finance scientific research on the use of distributed energy and renewable energy sources on the territory of the Kaliningrad region. The team has a scientific basis for solving scientific problems [13–16].
- 5) The need to assess the relationship between energy efficiency and climate change for consumers in training courses in the areas of "Electricity and Electrical Engineering", bachelor and master level and "Electricity and heat engineering" (Level of highly qualified personnel).

7. What are the gaps at HEI in integrated education on consumer behavior relevant to energy efficiency and climate change (please list up to five major gaps):

- 1) It is necessary to provide the concept of consumer behavior related to energy efficiency and climate change in integrated education of bachelors, masters and doctors of science; this is a real means of solving a wide range of social, economic and environmental problems.
- 2) In the advanced training programs for energy profile specialists conducted by the institution, there is a need to introduce a section on consumer behavior and role in solving problems related to energy efficiency and climate change.
- 3) Preparation of materials and examples for mass media on the efficiency of using highly efficient energy saving technologies and renewable energy sources in the region, including in the field of consumer behavior related to energy efficiency and climate change.
- 4) The concept of the World Energy Council (WEC) proposed 10 political actions to achieve three energy goals: accessibility, availability and acceptability of energy, fundamental for ensuring political stability throughout the world, for the energy business strategy and the world achieving a sustainable future. This concept could be taken as the basis for the development of consumer-related modules for energy efficiency and climate change.
- 5) Insufficient state of education with school students on the effectiveness of using highly efficient energy-saving technologies and renewable energy sources, including in the area of consumer behavior related to energy efficiency and climate change.





## 5.2 Organisational capacities

*This part describes the organizational capacities pertinent to integrated education on consumer behavior relevant to energy efficiency and climate change at HEI. Please answer following questions.*

1. Is integrated education on consumer behavior relevant to energy efficiency and climate change sufficiently included in the curricula of HEI? Please specify according to different levels (bachelor, master, PhD): It is partially included on different levels of education.

1.1. Study program level (Please list relevant study programs):

"Electric Power Electrical and Electrical Engineering" (Bachelor and Master), "Electric and heat engineering" 09.05.03-Electrotechnical complexes and systems (PhD).

1.2. Study subject level (Please list relevant study subjects/modules):

"Electric Power Engineering and Electrical Engineering" bachelor training modules: "Power supply", "Energy-saving power supply technologies", "Renewable energy sources".

"Electric Power Engineering and Electrical Engineering" master training modules: "Research Methods in the Electric Power Industry and Electrical Engineering", "Energy Efficiency in the Engineering Systems of Stations", "Electrical Engineering Standards".

"Electric and heat engineering" of scientific specialty 05.09.03-Electrotechnical complexes and systems doctor of science training modules: "New technologies of production, transmission and use of electric energy", "Renewable energy sources".

1.3. Study topic level (Please list relevant study topics):

"Electric Power Engineering and Electrical Engineering" bachelor training topics of study: electricity consumers, power quality, energy saving at industrial enterprises, energy saving in energy consumption, wind power plants, secondary energy resources, energy storage and transmission.

"Electric Power Engineering and Electrical Engineering" masters training topics of study: revision and analysis of modern and promising technologies in the field of production, transmission and consumption of electric energy, analysis of approaches, research methods in the implementation of technologies in the field of electric power, energy saving and resource saving in the production and distribution of heat and electricity, basics of energy audit of buildings and structures, economic and organizational direction of energy conservation and energy efficiency.

"Electric and heat engineering" of scientific specialty 05.09.03-Electrotechnical complexes and systems doctorate training topics of study: scientific principles of the use of alternative and renewable energy sources: analysis, temporal characteristics, quality, an integrated approach to energy planning, technical and socio-economic problems of using non-conventional and renewable energy sources; "Smart Home" and the principles of its construction; Ecological consequences of the widespread development of renewable energy sources; Problems of solar energy development; The influence of wind energy on the environment; Environmental characteristics of the use of bioenergy plants.

2. Is funding sufficient for integrated education on consumer behavior relevant to energy efficiency and climate change at HEI? Please specify.

The Ministry of Education and Science of the Russian Federation annually finances the recruitment of students to a higher education institution on a budgetary basis in the following areas: "Electric Power Engineering and Electrical Engineering" bachelor and master degrees and "Electric and heat engineering (PhD level)". This allows the university to carry out integrated education in the field of consumer behavior related to energy efficiency and climate change within these areas. Thus, the



university has sufficient funding for integrated education in the field of consumer behavior related to energy efficiency and climate change.

3. What are the needs at HEI in integrated education on consumer behavior relevant to energy efficiency and climate change related to organization of study process (please list up to five major needs):

- 1) Creating information and educational system university based in the field of energy conservation, including the field of consumer behavior related to energy efficiency and climate change, will require the creation of online training materials (videos available to the public, simulators (calculators and software).
- 2) Development of several modules. Modules: "Energy efficiency" (bachelor level), "Organization and methodology of scientific research" (master level) as the part of "Electric Power Engineering and Electrical Engineering" training programs. Module: "Newest technologies of electrical energy production, transfer and usage" as the part of "Electric and heat engineering" (PhD level) training program. It will require inclusion of above mentioned modules in the appropriate curriculum.
- 3) Standards on energy efficiency, mandatory building codes and regulations, planned indicators related to the use of highly efficient energy-saving and environmentally friendly technologies for consumers in training courses in the areas of " Electric Power Engineering and Electrical Engineering", bachelor degrees and master degrees "Electric and heat engineering" (PhD level) should be included in the teaching fund.
- 4) Conducting research on the use of distributed energy and renewable energy sources in the territory of the Kaliningrad region can be organized and carried out throughout the period of practice.
- 5) It is very important that the hierarchical coordination in curricula and organization of the educational process is related to energy efficiency and climate change for the energy consumer in training courses in the following areas: "Electric Power Engineering and Electrical Engineering", bachelor and master levels and "Electric and heat engineering" (PhD level).

4. Please list up to five major gaps in integrated education on consumer behavior relevant to energy efficiency and climate change related to organization of study process:

- 1) Organization of the step by step implementation of integrated education of bachelors, masters and doctors of science on the problem of consumer behavior related to energy efficiency and climate change as part of the educational process.
- 2) Organization of classes for advanced training conducted by the university for energy specialists, on the behavior and role of the consumer in problems solving related to energy efficiency and climate change.
- 3) Development of materials and examples for the media on the efficiency of using highly efficient energy-saving technologies and renewable energy sources in the region, including in the field of consumer behavior related to energy efficiency and climate change, and their use in the educational process.
- 4) Organization of special trainings for the students on the effectiveness of using highly efficient energy-saving technologies and renewable energy sources, including in the field of consumer behavior.
- 5) Creation of a specialized audience of high-efficient energy-saving technologies, including materials on consumer behavior related to energy efficiency and climate change, with a view to its use in the educational process.



### 5.3 Individual capacities: Staff skills

*This part describes the individual staff capacities pertinent to integrated education on consumer behaviour relevant to energy efficiency and climate change at HEI. Please answer following questions.*

1. How many academic staff works at your unit? (which implements the project): 4

2. Is there sufficient number of teachers who specialise in integrated education on consumer behaviour relevant to energy efficiency and climate change? How many?

2.1. At university level: 12

2.2. At your unit/department: 6

3. Is there sufficient number of researchers who specialise in consumer behaviour relevant to energy efficiency and climate change? How many?

3.1. At university level: 12

3.2. At your unit/department: 6

4. Please describe the current state of the staff training in HEI. Is it sufficient?

The university staff, as a rule, annually undergo advanced training, participate in the implementation of scientific research, reports at Russian and international conferences.

5. Please describe the current state of the staff training on consumer behaviour relevant to energy efficiency and climate change. Is it sufficient?

The staff of the university, in connection with the implementation of this project, thoroughly analyzes the existing and promising training programs for bachelors, masters and doctors in order to prepare topics on consumer behavior related to energy efficiency and climate change, and their inclusion in curricula. This is sufficient for the implementation of the project.

6. Does the academic staff have flexibility in designing its own skill development plans or does it have to follow a centrally determined package?

Faculty members have the freedom to develop their own skills development plans.

7. Is there staff stability, or does it suffer from high turnover among such professionals?

At the department and in the structure of the university, implementing this project, there is no staff turnover.

8. What staff skills are required for integrated education on consumer behaviour relevant to energy efficiency and climate change (please list up to five major needs):



Appropriate education, diligence, active participation in research, participation with reports at congresses and conferences related to energy efficiency and climate change, communication and cooperation with leading specialized enterprises.

9. Please list up to five major gaps in integrated education on consumer behaviour relevant to energy efficiency and climate change related to staff skills:

Low awareness in the media, lack of access to information, closeness of technical information of companies about their technological breakthroughs, a small number of high-quality textbooks, the need to create specialized laboratories in universities for the implementation of technical solutions made by students and graduate students in consumer behavior related to energy efficiency and climate change



## 5.4 Access to Information, Knowledge and Technology

*Access to information, knowledge and technology is becoming increasingly critical for sustaining long-term growth and development of education. It relates to the capacity to enable academic staff and students to mobilize, access and use information and knowledge, including access to and effective use of internet. Please answer following questions.*

1. Do students and teachers have access to the novel educational resources on consumer behaviour relevant to energy efficiency and climate change? Please specify:

### 1.1. Printed learning materials in national language:

Students and teachers of KSTU have access to educational resources in printed form in the library system of KSTU. It contains in free access to 19 documents and 457 articles of periodicals in the field of "energy efficiency", 60 documents and 115 articles of periodicals, including materials in the field of "climate change", 119 documents and 29 articles of periodicals, including material in the field of "consumer behavior" in print. Approximately 10% of these publications address consumer behavior in relation to energy efficiency and climate change. It is possible to deliver books by interlibrary card.

### 1.2. Printed learning materials in English or other languages:

KSTU library has only a few free access documents in the indicated areas in English, in particular: Sustainable development [Text]: textbook / B. Nath, L. Hens, D. Devuyt. - Brussels: VUBPRESS, 1998. - 365 p. Energy. From fossil fuels to sustainable energy resources [Text] / J. Salay, P. Borjesson, P. Helby. - Uppsala: Uppsala Publishing House, 1997. - 52 p. If necessary, a large number of publications, including in foreign languages can be obtained using the interlibrary card.

1.3. Online learning materials (open-source videos, simulators (calculators and software), case studies, text material) in national language: Students and teachers of KSTU have free online access to the following educational resources in Russian:

- 1) The University Library Online electronic library system. Address for work in the system: <http://biblioclub.ru>
- 2) Electronic library system «Book.ru». Work Address: <https://www.book.ru/>
- 3) Publishing "Lan". Work Address: <https://e.lanbook.com>
- 4) National Electronic Library (NEB). Address for work: <https://neb.rf/>
- 5) Polpred.com Media Review. Work Address: <http://polpred.com/news>
- 6) The electronic library system of the publishing house "Urayt". Work address: <http://biblio-online.ru>
- 7) Electronic library system IPRbooks. Work address: <http://iprbookshop.ru>
- 8) Publishing Center "Academy". Work Address: <http://www.academia-moscow.ru>

These library systems are not limited to book resources only, but also contain interactive and multimedia educational content, e-learning courses and tests. In addition to the above library systems, the KSTU library allows access to a large number of educational resources, including those including online courses. More information: <http://klgtu.ru/library/elib/>

1.4. Online learning materials (open-source videos, simulators (calculators and software), case studies, text material) in English or other language:

KSTU students and teachers have free online access to materials from more than a hundred foreign journals in various fields, including in the field of energy efficiency. The full list is available at the link: <http://klgtu.ru/library/elib/index5.php>



In addition, students and teachers of KSTU have free online access to a large number of resources including training materials, video courses, etc., including the most well-known and high-rating databases like Scopus, WebOfScience, Nature Science, Elsevier, Wiley, Taylor & Francis, IEEE etc. More information on the link: <http://klgtu.ru/library/elib/eor/>

2. Does HEI use MOODLE for educational purposes?

KSTU uses its own electronic educational environment, developed on the basis of MOODLE.

3. Does HEI use computer-based intelligent systems, MOOCs, computer learning systems, big data mining for educational purposes? Please specify:

At present, the electronic educational environment allows students to develop access to their own MOOC courses within the scope of the MOODLE platform. A number of courses in the direction of "economics" is already available for students. Consideration is being given to the possibility of preparing such courses in English as part of the implementation of the master program in the field of "Electric power industry and electrical engineering".

There is a techno park in KSTU which has accelerated interaction of companies in the high-tech sector due to the presence of a developed infrastructure and the provision of essential services. A number of projects implemented in the techno park use computer intelligent systems, computer learning systems, and big data mining. At the same time, for educational purposes, besides involving individual students in the work on the projects being implemented, these areas are not used.

4. Does HEI use software for integrated education on consumer behaviour relevant to energy efficiency and climate change? Please specify:

KSTU does not use specialized software in the scope of consumer behavior related to energy efficiency and climate change. At the same time, in the scope of energy efficiency and energy saving, the program products EPLAN and RASTR which licensing for the needs of the university at this day can be considered as applicable.

5. What Information/Knowledge/Technology is required for integrated education on consumer behaviour relevant to energy efficiency and climate change (please list up to five major needs):

- 1) Implementation of modern information-educational environment in the field of energy conservation, including in the field of consumer behavior related to energy efficiency and climate change is required.
- 2) It is necessary to prepare a large number of educational materials, including interactive educational resources for filling the information-educational environment, which will require the use of a large amount of time resources of university teachers.
- 3) For the full implementation of such programs, it is necessary to upgrade the English proficiency skills of some teachers.
- 4) It is necessary to introduce computer intellectual systems, computer learning systems, big data intellectual analysis for educational purposes in the specified area on the basis of the university.
- 5) It is necessary to ensure closer cooperation with representatives of the industry in order to organize the improvement of their qualifications and ensure the practice of students in this area.



6. Please list up to five major gaps in access to information, knowledge and technology pertinent to integrated education on consumer behaviour relevant to energy efficiency and climate change:

- 1) Low level of proficiency in foreign languages, both students and teachers.
- 2) Insufficient use of modern educational methods and tools, educational and methodological approaches in the implementation of educational programmes.
- 3) Insufficient material support and the provision of modern program-based tools used by educational programs.
- 4) A low basic level of education in the field of energy preservation, the lack of trained specialists in this field and, as a consequence, the complexity of integrating narrowly specialized courses into educational programs.
- 5) The complexity of registration and access to foreign databases of educational resources in foreign languages. Access to a number of them is possible only from the local network of KSTU. The expected creation of an intranet and controlled access to the Internet by Russian users.