

Republic of Belarus  
Republican Institute  
for Vocational Education  
Resource Center  
"EcoTechnoPark – Volma"



<https://etp-volma.by/>



## About us

Activity spectrum of the Resource Center "EcoTechnoPark – Volma": energy, energy efficiency, ecology and energy efficient construction, crop growing and fisheries.

- ◉ Key focus areas:
- ◉ Educational activities;
- ◉ Production-and-training activities;
- ◉ Scientific research and innovative-and-experimental activities.

The Resource Center provides premises for implementation of the network-based educational programmes for the students of technical vocational, secondary specialized and higher education institutions, as well as for engineers and other technical workers of organizations and enterprises by profile.

**Networking as a form of interaction** constitutes a common effort of the partner institutions towards development and implementation of joint programmes, mobility of pupils, students and teachers, recognition of the students' learning outcomes after mastering the educational programme in other partner institution, resource sharing, etc.

## Laboratories and educational services

The following scientific research and educational laboratories have been created and outfitted with training equipment of the leading world manufacturers in order to implement activities in the listed areas (<https://etp-volma.by/laboratorii/>)

# VOCATIONAL EDUCATION DIDACTICS OF THE CENTER IN THE NETWORKING CONTEXT

## KNOWLEDGE

Training of the course participants in laboratories in test-bench equipment and training software complexes of the Center when studying the theory



## SKILLS

Skills development in the framework of practical exercises on the training equipment of the Center



## COMPETENCIES

Forming professional and cross-sectoral competencies across sectors in the framework of high-tech production of the Center

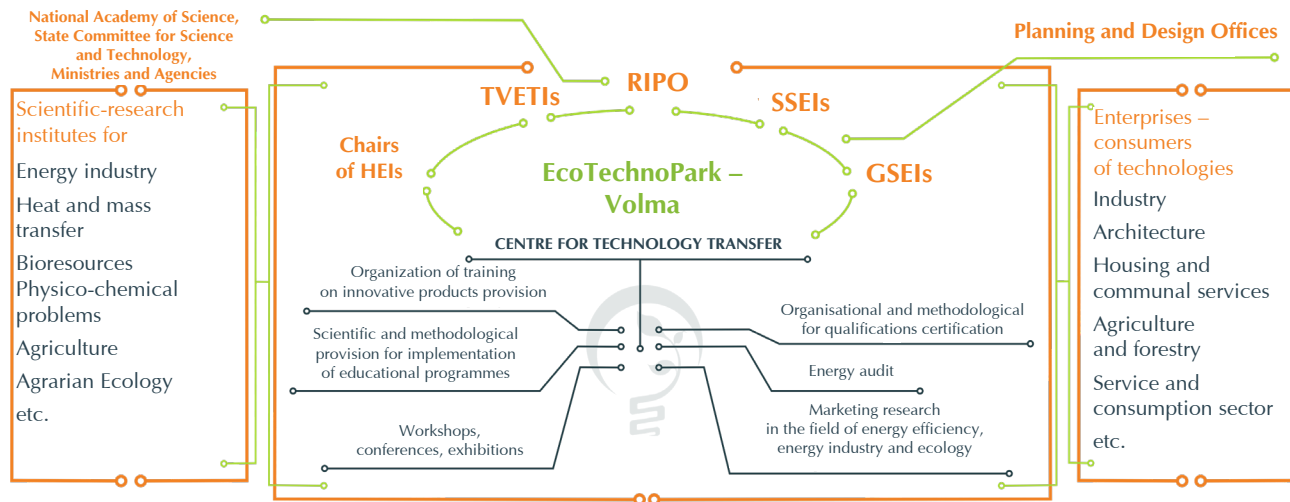


## VALUES AND MOTIVATION

Setting the stage for forming supra-professional competencies in students: leadership, team building, entrepreneurship



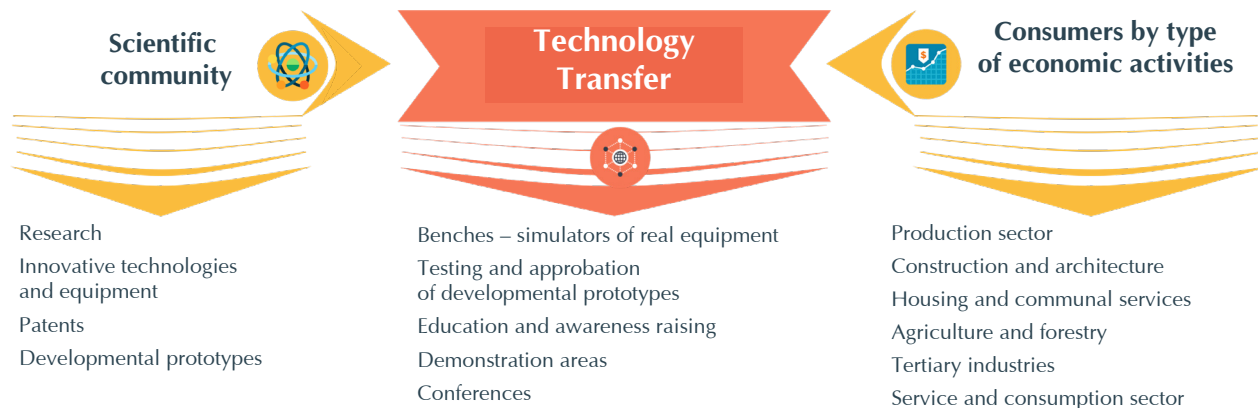
## "ECOTECHNOPARK – VOLMA" – RESEARCH, PRODUCTION AND EDUCATIONAL CLUSTER



The structure of the cluster includes EcoTechnoPark – Volma, which is the core of the cluster, field specific chairs of HEI, TVET and SSE institutions, Volmyansk educational and pedagogical complex, kindergarten – basic school, organizations and enterprises of the construction industry, housing and communal services, energy industry, production sector and agriculture

## THE CONCEPT OF THE CENTRE FOR TECHNOLOGY TRANSFER BASED ON THE CLUSTER APPROACH

By the order of the State Committee on Science and Technology of the Republic of Belarus dated August 8, 2017, the resource center "EcoTechnoPark – Volma" was registered as a subject of innovation infrastructure – *the Center for Technology Transfer*



The center's activities are aimed at identifying the possibility of introducing high technologies in the real sector of the economy in the field of energy industry, energy efficiency and ecology, created on the basis of the results of scientific research, as well as at promoting innovative technologies, products, services through training employees of educational institutions and production organizations of various sectors of the economy



Training laboratories of the resource center "EcoTechnoPark – Volma" are created with the support of the Government of the Republic of Belarus and the European Union.

**In educational laboratories, there have been conditions and opportunities created for forming the following competencies among different categories of students:**

- informational;
- design and technological (designing, production, operation, maintenance, repair of high-tech equipment and intelligent energy supply systems);
- economic;
- ecological;
- managerial;
- research



# TRAINING LABORATORY “HOUSING AND COMMUNAL SERVICES WITH THE APPLICATION OF RENEWABLE ENERGY SOURCES”



Bathroom modeling

**An exercise bike – generator of electricity**

The power generating system allows for studying conversion of mechanical energy into electrical energy.

**Conversion of mechanical energy into electrical energy**

Allows for studying the production of electricity using a generator to power various consumers.

**A mobile solar energy plant for basic training**

Provides an opportunity to familiarize yourself with the electrical circuit – starting from the energy source and cables to consumer modules and energy storage

**Photovoltaics for off-grid and on-grid experiments**

Enables the design and construction of a solar array system for practical use.



Pipeline hydraulic heating system

**Installing equipment in the bathroom**

Allows for planning configuration of the bathroom and evaluate the mechanism of operation and functionality of plumbing devices, and adjust them.

**A solar power plant with a set of additional equipment**  
Allows for collecting various electrical circuits using a solar panel and perform practical tasks in natural conditions.



Renewable energy heating system

# TRAINING LABORATORY “HOUSING AND COMMUNAL SERVICES WITH THE APPLICATION OF RENEWABLE ENERGY SOURCES”

## Studying of gas technologies

Allows for replacing a section of the pipeline, inspection of a gas installation, analysis, planning and implementation of fuel supply systems.

## Drinking water supply system

Ensures mastering of the knowledge about the installation of drinking water supply systems, about measures to combat corrosion in these systems.

## Hydraulic heating system

Allows for testing the system, program the thermostat, test operation on a membrane-type expansion tank, and also take temperature readings on a 4-channel measuring device with a data interface.

## The heat pump as the centerpiece of the entire system

Allows for exploring the heat pump system, planning, installation and configuration of heating systems, physical heat pump cold cycle processes, optimization energy processes in heating systems.

## Direct current technology

### Alternating current technology

Allows for exploring sequential and parallel connections, jumper circuit, latching relays, diodes in a DC circuit, high and low bandwidth circuits, transistors, field-effect transistors.



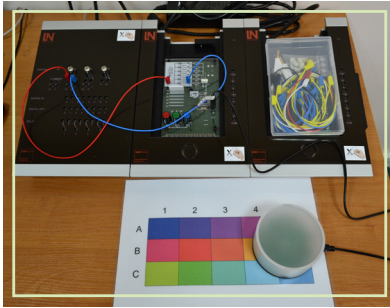
Gas Equipment

## Pipeline hydraulic heating system

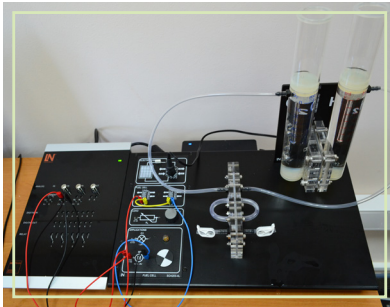
Provides an opportunity to study the influence of the heating system components on each other and the damage that can be caused by air in the heating system. Allows for performing replacement of the thermostat valve under pressure in the operating mode.



# TRAINING LABORATORY “FUNDAMENTALS OF THE ENERGY INDUSTRY”



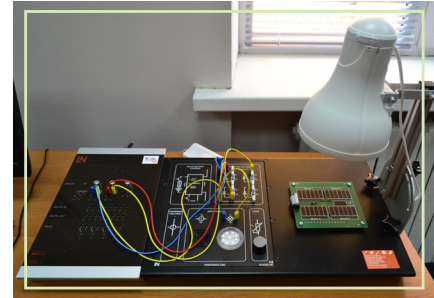
LED lighting and color recognition



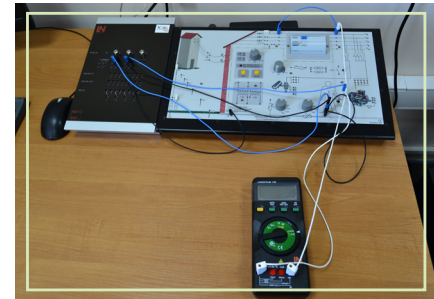
Fuel elements

## UniTrain multimedia experimental training system

Allows for mastering the following courses: "DC, AC and Three-Phase Current Equipment", "Magnetism / Electromagnetism", "Measurement with a Multimeter", "Networks and Network Models", "Current and Voltage Transformers", etc. The software of each course is clearly structured and includes texts, graphics, animations and tests for knowledge assessment, as well as a set of experimental cards containing practical tasks.



Photovoltaics



Types of the power supply and protective measures

# TRAINING LABORATORY “RENUWABLE ENERGY, ELECTRICAL SYSTEMS AND CIRCUITS”



Conversion of mechanical energy into electrical energy



Small wind power plants

## Advanced photovoltaics

Allows not only for becoming acquainted with the principle of operation of solar panels and carrying out various studies, but also to simulating a photovoltaic system in the direct power supply mode or in the storage mode.

## Photovoltaics

Allows for investigating the work of solar modules, working out the skills of assembling and testing of a photovoltaic installation.

## Electrical power generation

Allows for simulating a power plant operation in isolated and joint modes, as well as regulating, synchronizing and protecting generators.

## Power distribution

Built-in instruments enable immediate analysis of switching operations. Collecting buses consist of input and output panels as well as connection panels and transformer panels.

## Transformers

Allow for considering the transformer substitution circuit during experiments and defining the characteristic quantities by measuring.

# TRAINING LABORATORY “RENUWABLE ENERGY, ELECTRICAL SYSTEMS AND CIRCUITS”

## Smart Grid (Smart power grid)

Allows for combining training systems for electric power generation, transmission and distribution, equipment protection and electric power management.

## Power management

Allows for carrying out experiments with manual and automatic compensation of reactive power, measurements with a kilowatt meter and a counter of maximum values, as well as studying the topic of consumers protection against electricity.

## INTERACTIVE LAB ASSISTANT

Allows for safe experiments with hydrogen and a fuel cell, suitable for both demonstration and training.

## Wind-powered generator

Provides for studying modern wind turbines with dual power generators. The wind can be emulated with the help of a servo test bench and WindSim software.

## Electric power transmission

The network modelling is designed in such a way that the model voltage is in the range of 110–380 kV.

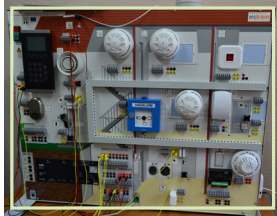


Energy supply management

Hydroaccumulating electric power plants



# TRAINING LABORATORY “SMART HOUSE”



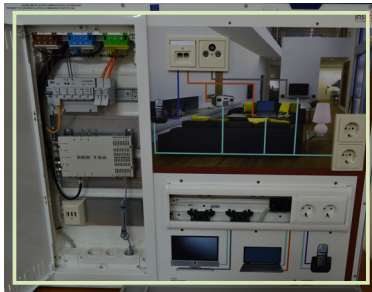
Alarm signaling  
and access control

## Alarm system and access control

Allows for studying an alarm system installation made of a typical components used in practice, all of which, without exception, are VdS-approved.

## House connection

Allows, by means of a fault simulator integrated into the hardware, to set and solve various tasks for connecting the power supply network to the electrical system of the building, for proper execution and verification of this system.



Communication technology

## Communication technology

Is meant for the design, installation and testing of structured cabling for telephony, Internet, network connections, TV and video. Refers to the Home Office area.

# TRAINING LABORATORY “SMART HOUSE”

**Building management systems with KNX**  
Is meant for the design, installation and testing of an intelligent wiring system suitable for bus connection.

Lighting equipment



## Protection measures according to VDE / EN

Provides an opportunity to get acquainted with the safety measures according to VDE 0100 in various types of networks for everyone who, by vocation, is engaged in the set-up, operation and repair of electrical installations.

## Turning on lamps and devices

Is meant for the design, installation and testing of widely used wiring diagrams.

## Security and fire alarm

With the help of this simulator, the topic of antiburglar and fire protection is revealed as a decisive element of a modern wiring system. The focus is on the principle of operation of the individual sensors and the integration of various detectors, sensors, activation devices and the control room into a single system. The installation can be easily programmed and very differently used for high performance-oriented teaching.



Photovoltaic panels with sunlight simulation



# TRAINING LABORATORY “BIOENERGY”



Biotechnological production  
of ethanol

## Experimental installation CE 640

Allows for investigation of the biotechnical ethanol production process. The system is controlled and monitored by a programmable logic controller (PLC). The set of experiments study the influence of the process parameters on the content, amount, yield of ethanol in relation to the investigated mass of raw materials. An additional PC is required to collect data.



Biogas production



Biodiesel production

## Experimental installation CE 650

Reproduces the process of biodiesel production in laboratory conditions. It is meant for studying the influence of time and temperature on the biodiesel production from vegetable oil; the process of chemical transesterification, distillation, etc.

## Installation CE 642

Demonstrates the practical production of biogas using biomass. Installation control and data collection is carried out using a programmable logic controller (PLC) with a touch screen. It is meant for studying the influence of various variables on biogas production, its rate and biogas output.



### Renewable Energy Sources Laboratory (equipment produced by Festo Didactic and Schneider Elektric Bel)

**Designation of the laboratory:** laboratory benches for studying the principles of generation, conversion and use of the solar energy, wind energy, water power and operating installations for researching the real life equipment functioning, setting-up and maintenance.

**Target audience:** secondary specialized and higher education; additional education / retraining (adult population)



### Charging Station Laboratory (equipment produced by Lucas Nulle and Schneider Elektric Bel)

**Designation of the laboratory:** laboratory benches and software for studying and practical use of the charging stations infrastructure, their installation, application, adjustment, maintenance and additional charging equipment.

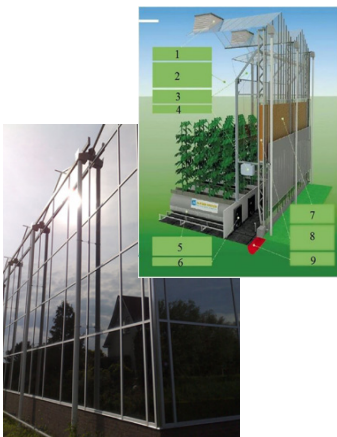
**Target audience:** technical vocational education; secondary specialized education; higher education; additional education / retraining (adult population)



## Innovative Renewable and Traditional Energy Greenhouse Technologies Laboratory

**Designation of the laboratory:** studying of the smart house system functioning and maintenance.

**Target audience:** secondary specialized education, higher education, retraining and further training of the engineering staff and specialists in the field of construction and energy supply of buildings.



## Building Utility System Control Automation Laboratory (Energy-efficient house) (equipment produced by Schneider Electric Bel)

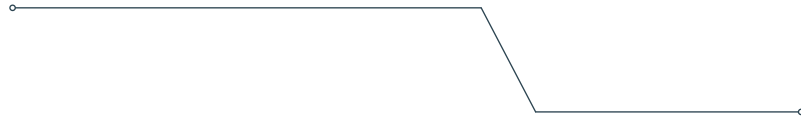
**Designation of the laboratory:** scientific, laboratory and production greenhouse complex for experimental-industrial testing of the effective interaction of the light field and biological objects. It allows studying biologically active light in agricultural areas (agro-, phyto-, aqua-, bio-lighting, radiation, irradiation) and solving the problem of optimal light field creation in industrial greenhouses and other cultivation installations for effective interaction between the light field and biological objects, development of technologies for stimulating seed material with biologically active radiation based on various radiation sources.



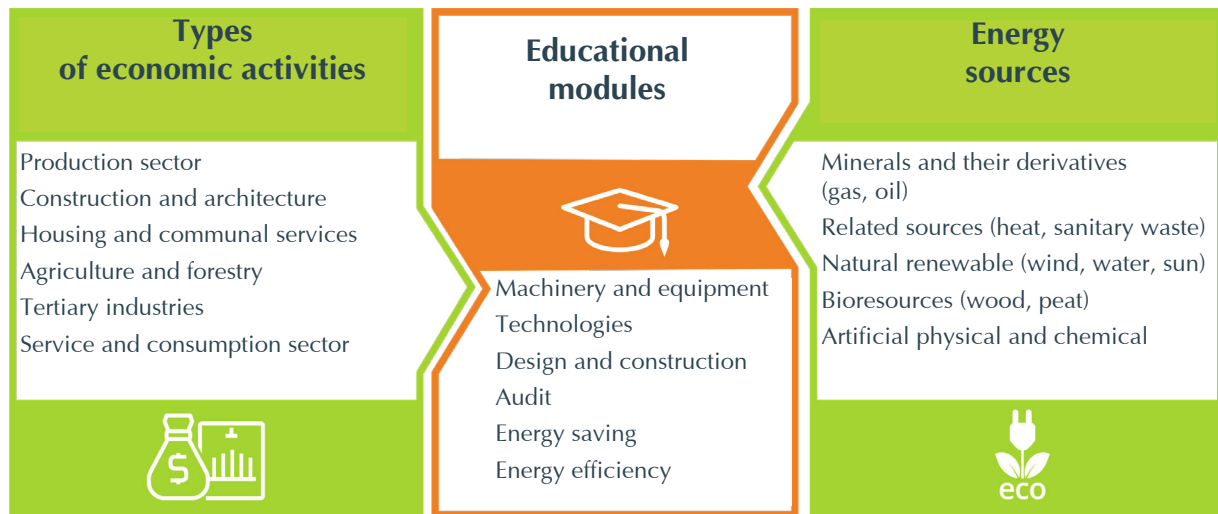
**Modern Construction Technologies Laboratory (technologies and equipment produced by LLC "Modern Concrete Structures"; JSC MAPID; Schneider Elektrik Bel; Vistar energetics; NVIDIA; Citrix; AMOLED; financing)**

**Designation of the laboratory:** educational, scientific and practical center for collective use of digital and energy-efficient technologies for autonomous energy supply, energy management and comfort control of a residential building, as well as technologies for energy-efficient heat engineering solutions at the stages of design, construction and operation of innovative construction demonstration facilities for energy-efficient houses with the use of prefabricated reinforced concrete structures.

**Target audience:** secondary specialized education, higher education, retraining and further training of the engineering staff and specialists in the field of construction and energy supply of buildings.



## THE CONCEPT OF EDUCATIONAL SERVICES



The development of educational content is based on a modular approach. Each educational module includes areas of knowledge necessary to form the competencies of specialists from various sectors of the economy, applying smart energy technologies using traditional and renewable energy sources.



## EDUCATIONAL PROGRAMS TO PARTICIPATE

List of educational proposals:

- intramural,
- group / individual,
- with a tutor
- distance (separate courses)

Training Course Title	Study Period, weeks	Types of Trainees
1. Renewable Energy Sources Technologies	1–3	Teachers and students of the educational institutions, specialists of the enterprises and organizations
2. Renewable Energy Sources Application in Plumbing Equipment	1–3	Teachers and students of the educational institutions, specialists of the enterprises and organizations
3. Solar Collector	1–3	Teachers and students of the educational institutions, specialists of the enterprises and organizations
4. Photovoltaic Panels	1–3	Teachers and students of the educational institutions, specialists of the enterprises and organizations

5. Heat Pumps in Construction	1–3	Teachers and students of the educational institutions, specialists of the enterprises and organizations
6. CE 640 Biotechnical Ethanol Production Experimental Plant	1–3	Professionals of the following areas: <ul style="list-style-type: none"> <li>• Food Technology</li> <li>• Renewable Energy Sources</li> <li>• Process Engineering</li> <li>• Bioprocess Development</li> </ul>
7. CE 650 Biodiesel Fuel Production Experimental Plant	1–3	Professionals of the following areas: <ul style="list-style-type: none"> <li>• Chemical Engineering</li> <li>• Reaction Technologies</li> <li>• Production and Technological Equipment</li> <li>• Industrial Chemistry</li> <li>• Renewable Energy Sources</li> </ul>
8. Emergency Alarm System Technologies	1–3	Students of the educational institutions and "Security and Fire Alarm Electric Fitter" workers

## 9. Renewable Energy Sources Lab

### Sessions:

- Energy Loss Tests
- Ventilation System Measurement
- Flat-Plate Collector Solar Plant
- Ventilator Head Characteristics
- Solar Collector Heat Power
- Ventilation System Device
- Heating System Device
- Solar Collector Efficiency Factor

1–3      Students of educational institutions

## Apprenticeship/Retraining/ Advanced Training/ Scientific Work

10. Scientific work (based on training laboratories areas)	1–4	Students and Ph.D. candidates
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11. Apprenticeship/retraining in the following areas:

- |  |               |  |
|--|---------------|--|
| <ul style="list-style-type: none"> <li>- Renewable Energy Sources in Housing and Communal Services</li> <li>- Renewable Energy in Electric Power Network</li> <li>- Energetics Essentials</li> <li>- Heat-power Engineering</li> <li>- Water Treatment</li> <li>- Smart House System</li> <li>- Modern Building Management System</li> </ul> | from 14 weeks | Students and Ph. D. candidates of educational institutions, heads and professionals of the enterprises and organizations |
|--|---------------|--|

12. Advanced Training "Integration of Sustainable Development Ideas in the Educational Process"	1–2	Heads, teachers and professionals of the educational institutions
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**Educational Institution**  
**“Republican Institute for Vocational Education”**  
**“Resource Center EcoTechnoPark – Volma”**  
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