SOLVING THE PROBLEM OF TRAINING SPECIALISTS IN THE OPERATION OF SOLAR ENERGY DEVICES

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Abstract. *The implementation of the project by partner universities will provide significant assistance to the field of operation and maintenance of the country's growing solar energy system. It is assumed that the project will satisfy the expected high demand for specialists with a strong combination of theoretical and practical skills in the field of operation and maintenance of solar energy systems. The list of curricula and programs to be improved is indicated.*

Keywords: *project, partner, renewability, solar energy, direct and variable current, Baccalaureate, Program, Improvement.*

Many energy collapses of recent years have led people to the idea of the urgent need to find new sources of energy to replace the gradually disappearing hydrocarbon reserves. Naturally, at the same time, RES - renewable energy sources, including solar energy, are in the first positions, especially for Uzbekistan [1-20].

The possibilities of solar energy are really impressive in their inexhaustibility, which, unfortunately, cannot be said about the applied possibilities of its development. The main problem is the low efficiency of solar panels and a number of operational problems with the use of solar electricity. Therefore, this problem is currently attracting the attention of many researchers. In particular, solar energy among all other mass types of energy is a source of direct current. The entire infrastructure of human energy consumption, transportation and production is based on alternating current, while solar electricity is direct current and its consumption requires other operational skills and other electrical devices.

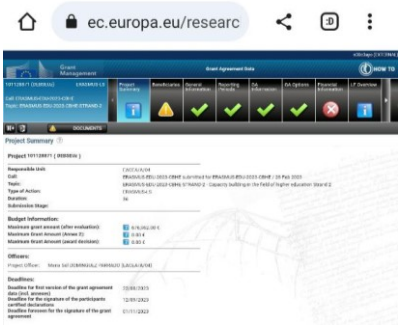
Therefore, the task itself is put forward in advance to take appropriate measures for the operational training of electrical engineers in the field of solar energy, who will be able to provide qualified consumption, transportation and production of permanent solar electricity.

The entire process of higher education should be aimed at such modernization of the entire educational process, its educational and methodological support, competent updating of the entire cycle of analytical and practical content of educational content.

On the eve of the implementation of grandiose energy projects in Uzbekistan (until 2030, the total capacity of all new solar power plants should reach 8 GW) in the field of solar energy, the task of improving the training process of relevant engineering and technical personnel is an extremely timely and very effective means of dramatically improving the welfare of the people for many years.

The reality and feasibility of the proposed problem also lies in the fact that it can be based on the extensive accumulated experience of the EU countries in the development of renewable energy sources over the past two or three decades. Assuming the possibility of borrowing some of

their positive results, we have prepared a project DEBSEUz - Development of the targeted Educational program for Bachelors in Solar Energy in Uzbekistan for the Erasmus+ program. He successfully passed the review and, following the results of the selection in 2023, was accepted for funding (the corresponding acceptance document is on the photo and on the website https://ec.europa.eu).



The project is aimed at solving the problem of the shortage of qualified highly specialized specialists in the installation, management, and maintenance of solar power plants and its components in Uzbekistan. The main objective of the project is to develop a curriculum and training courses for bachelors in the field of renewable energy engineering using modern equipment for the installation and maintenance of solar power plants in Uzbekistan through innovative training programs that meet the requirements of the world market and EU best practices. It is planned to implement the following objectives:

Development of a bachelor's degree curriculum based on world standards in the field of renewable energy engineering;

Development of a training program for bachelor's degree designers and engineers in the maintenance of renewable energy systems;

Development of methods of teaching specialized subjects on renewable energy supply systems for the teaching staff of higher educational institutions of Uzbekistan based on world experience;

Development of courses and manuals for the training and retraining of professors and teachers for teaching specialized subjects;

Development of bachelor's degree standards in the areas of renewable energy;

Testing, adaptation and accreditation of curricula, materials and methods;

Development of collections of laboratory works intended for the practical implementation of solar power plant systems;

Development and publication of new generation reference books;

Creation of regional training centers and a Society of Renewable Energy Engineers;

women, migrants and people suffering from social and economic barriers in training courses and programs are involved.

Performing these tasks will allow you to get the following results:

- 1 ECTS accredited Bachelor's degree program in Renewable energy;
- 12 newly developed courses for the bachelor's degree program;
- 2 new programs of training courses to improve qualification;
- 1 web platform with educational materials and methodological guidelines for practical and laboratory work (including books, manuals, video materials);
- 1 innovative laboratory rooms with equipment and autonomous power supply based on a solar power plant;
- 2 regional training centers for training and retraining of specialists;
- Engineering Society for Renewable Energy Supply Systems including teachers and graduates of courses;
- 1 leading student and mentor co-working centers focused on projects based on the development and implementation of renewable energy systems;

- 150 bachelors will be trained according to the new curricula;
- More than 20 technical specialists and unemployed people will be trained in the training centers;
- 24 teachers and specialists will be trained by EU partners.

The process of engineering education consists of 32 courses, of which 12 disciplines are subject to complete modernization in accordance with the project, and 6 are subject to partial modernization.

№	Disciplines of complete modernization:	№	Disciplines of partial modernization:
1	Theoretical Electrical Engineering	1	Parameters of photovoltaics devices
2	Electronics	2	Physics of photovoltaics devices
3	Electrical installations	3	Applied photovoltaics
4	Industrial electrical installations	4	Physics of photovoltaics materials
5	Relay protection	5	Optics of photovoltaic materials
6	Installation of electrical equipment and protection	6	Operation of industrial electrical installations and equipment
7	Energy supply of industry		
8	Urban electrical supply		
9	Power plants		
10	Electric machines		
11	Setting up electrical equipment		
12	Over voltage and protection		

The growing demand for solar energy provokes an increase in demand for highly qualified, highly focused specialists in this field.

The project was put forward in accordance with the Law of the Republic of Uzbekistan dated May 21, 2019 No. LRU-539 “On the use of renewable energy sources” and is aimed at solving the tasks set out in the Decrees of the President of the Republic of Uzbekistan and resolutions of the Cabinet of Ministers of the Republic of Uzbekistan. Ministers of the Republic of Uzbekistan:

- No. PD-220 dated September 9, 2022 "On additional measures for the introduction of energy-saving technologies and the development of low-power renewable energy sources",
- No. PD-165 dated July 6, 2022 “On approval of the Strategy of innovative development of the Republic of Uzbekistan for 2022-2026”,
- No. 640 dated 09/10/2020 "On approval regulations on the extra-budgetary intersectoral energy saving fund under the Ministry of Energy of the Republic of Uzbekistan". Uzbekistan",
- No. 568 of 05.10.2022 "On approval of the regulations on the procedure for the purchase by the population of renewable energy installations produced by domestic manufacturers, with reimbursement of part of the costs of their purchase or in Installments",
- No. 518 of September 21, 2022 “On accelerating the production of devices from renewable energy sources”.

The project is implemented as partners by 7 national and 3 European organizations (MHSSERUZ is an associate partner):

1. TUIT - Tashkent University of Information Technologies
2. POLITO - Politecnico di Torino
3. UEVORA - Universidade De Evora
4. UPM - Universidad Politecnica De Madrid
5. TTPU - Turin Polytechnic University in Tashkent
6. JizPI - Jizzakh Polytechnic Institute
7. FerPI - Fergana Polytechnic Institute
8. ASU - Andijan State University
9. TIIAME-NRU - Tashkent Institute of Irrigation and Agricultural Mechanization Engineers National Research University
10. KSU - Karakalpak State University

(MHESIRUz) Ministry of Higher Education, Science and Innovations of the Republic of Uzbekistan

Conclusion. With the help of 10 partner universities of the country and the EU, the successful implementation of the project is expected. Over 150 specialists with a strong combination of theoretical and practical skills in the field of operation and maintenance of solar energy systems will be trained. There will be upgraded 12 academic disciplines, as well as curricula and programs.

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