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**[TEACHING MATERIAL IN ENVIRONMENTAL
ECONOMICS, ENERGY EFFICIENCY, RENEWABLE
ENERGY SOURCES AND ENVIRONMENTAL
IMPACTS- MASTER STUDY (ENERESE
PROGRAM)]**

Peer Review Report of the training material

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1.

1. Introduction

The major objective of the ENERESE is to introduce, support and promote the development of the new two years master programme on Energy Efficiency, Renewable Energy Sources and Environmental Impacts at State University of Novi Pazar (SUNP) in accordance with the European state of the art and standards. The master addresses the broad class of Bachelor engineers in Mechanical Engineering, Civil Engineering, Electrical Engineering and Technology in Serbia, Bosnia and Montenegro. Part of the project, which is of particular educational interest, is the re-training of lecturers, future lecturers (assistants) and also promising, outstanding students (future experts and assistants) by EU experts at SUNP and at EU universities, also with the aim to bring master curricula, teaching methods, laboratory and library facilities up the recognized standards. Finally, during the ENERESE emphasis will be given to reshaping curricula in general subjects, to increase the proportion of experimental and practical work, to introduce practical placements and to upgrade existing courses in general.

PEDL participates in the comparative analysis of existing strategies devoted to energy efficiency, alternative and renewable energy sources and environmental impacts in regional and EU consortium countries. It closely collaborates in the process of curricula development, its complete implementation at SUNP and in the management of project. Their teaching staff deliver retraining seminars at SUNP and PEDL for the regional teaching staff. The project is funded by European Commission - Joint projects – TEMPUS.

During the project period the new curricula established at partner universities included the following activities:

- Definition of strategies for the new master programme
- Development of the new restructured curricula
- Drafting of course outlines
- Methodology improvements for the new master programme.

Teaching staff from WB universities has been retrained at EU partner- universities where they attended courses, tutorials and scientific seminar/conferences on specific topics included in the Master curricula. Those activities are still going-on as this report is written.

Seminars by EU experts at WB partners have been and are complemented to the teaching staff training scheme.

New textbooks have been developed and published. Laboratories and libraries at regional partners are also in the process of being renewed

- At the start of the second project's year the new master programme started its implementation.

ECTS is in the process of being implemented and its calculation is based on the EU standards and partner countries experience.

- Quality control and monitoring is provided by the project management team.

Internal assessment is done by QA offices, the university Senate, Student Parliament and Ministry of education and external assessment by EU partners

- Dissemination process has been, and is being, performed during the whole project period with the elaboration of specific dissemination materials

- Sustainability of project results will be achieved through systematic validation by the faculty and university councils and by the accreditation recognition of the Ministry of Education

- Project management is provided by the coordinator and Project Management Team (PMT) assisted by administrative staff members for the follow up of project activities and project expenses

This report summarizes the results of the evaluation of the course modules presented in the frame of the new programme, which is replacing the existing one year Master programme at SUNP (Energy efficiency in buildings) by restructuring and enhancing it for application at all WB partner universities. The draft of curricula and the development of main course outlines with Diploma supplement do ensure harmonization with European Standards. Students are gaining additional skills, such as management, professional communication, usage of professional software packages in their work, dealing with modern technologies and ability to handle professional communication in English. This is mirrored in the educational material provided.

The purpose of the evaluation is to understand the value of the quality of the material presented to the courses targeting to an integrated approach of the significant issue of energy efficiency in buildings. Major findings and conclusions are described in details below.

Following the findings, recommendations for enhancing the course modules and the teaching process as such are presented.

The report was discussed with, and approved by University of Zilina (SK), University of Ljubljana (SL) and TU Bergakademie Freiberg (D).

2. The ENERESE Programme – Technical details

The major objective of the ENERESE, as already mentioned, is to structure the development of the new two years master programme at Energy Efficiency, Renewable Energy Sources and Environmental Impacts at State University of Novi Pazar (SUNP) in accordance with the European standards. The Consortium and the WPs of the programme which support the programme's targets are presented below.

Consortium

1. **State University of Novi Pazar** (Applicant) - Serbia
2. **University of Belgrade** (Partner) - Serbia
3. **University of Nis** (Partner) - Serbia
4. **Serbian Chamber of Engineers** (Partner) - Serbia
5. **Serbian Energy Efficiency Agency** (Partner) - Serbia
6. **University of Sarajevo** (Partner) - Bosnia and Herzegovina
7. **University of Banja Luka** (Partner) - Bosnia and Herzegovina
8. **University of Montenegro** (Partner) - Montenegro
9. **Ministry of Economy of Montenegro** (Partner) - Montenegro
10. **Chamber of Economy of Sarajevo Canton** (Partner) - Bosnia and Herzegovina
11. **University of Zilina** (Partner) - Slovakia
12. **University of Ljubljana** (Partner) - Slovenia
13. **Aristotle University of Thessaloniki** (Partner) - Greece
14. **TU Bergakademie Freiberg** (Partner) - Germany

Table 1. WPs of ENERESE project

Work Package	Type of work	Title of work package	Start	End
WP 1	Development	Strategy definition for master programme ENERESE	1	6
WP 2	Development	Development of new restructured Master study programme	4	12
WP 3	Development	Methodology improvements for new program	10	24
WP4	Development	Implementation of new master programme	12	36
WP 5	Quality plan	Quality control and monitoring of master study programme	4	36
WP 6	Dissemination	Dissemination of the project results	4	36
WP7	Exploitation	Sustainability of project achievements	6	36
WP 8	Management	Project management and coordination	1	36

3. Overview of the teaching goal, aims, system and material

The specific Task (WP4) presents an overview of the teaching material presented at the existing one year Master programme at SUNP (Energy efficiency in buildings). Within the scope of this project, and in the frame of this deliverable, emphasis was placed on information referring to:

- economy and investments, namely on Macroeconomics, capital cost, debt and equity structure, inflation, fiscal policy ,
- economic features of an investment, namely on Capital expenses, depreciation, revenues and expenses, cash flows, salvage values
- energy investment plans and time, namely on The time value of money, lead and implementation time, cost concepts and identification
- investment appraisal methods for energy production and energy conservation investments, namely on Net Present Value, Internal Rate or Return, Life Cycle Cost, Levelized Cost of Energy, Depreciated Payback Period
- tools to promote energy policies and renewable energy sources, namely on Feed in tariffs, Net metering, Alternative subsidies' schemes
- costing and pricing of energy, namely on Fixed and variable cost of power generation, sensitivity analysis, break even point
- Life Cycle Analysis of energy projects
- sustainability certification schemes and tools
- large and small scale energy business structures
- financing schemes, namely banking, equity financing, crowd funding etc, and
- legal aspects of energy projects, focusing on Large scale building refurbishment and renovation schemes, district heating systems etc.

The completion of the Master programme (which corresponds to 120 ECTS) has to be done in two years. This new programme replaces the existing one year Master programme at SUNP (Energy efficiency in buildings) by restructuring and enhancing it for application at all WB partner universities. The draft of curricula and the development of main course outlines with Diploma supplement is done in such a way that it ensures harmonization with European Standards and Directives. To a great extent this is mirrored in the packages of knowledge delivered by the teaching materials.

Another main aim is for the students to gain additional skills in topics that have not been widespread in the existing curricula, such as economics, management, professional communication, usage of state of the art software packages in their work, dealing with modern technologies and ability to handle professional communication in English. This was particularly important as it is a prerequisite in order to enhance the students' chances for employment and to help them to take a proper place in the regional and international society and economy. It is very expected that such professionals will become highly competitive on the local and regional labour market. Students have the choice of two modules of technologies to specialise in (1) Energy efficiency in buildings and RES and (2) HVAC and hybrid systems using RES.

A common mode for both modules includes subjects related to civil engineering, mechanical engineering and electrical engineering as well as to the subjects devoted to environmental science and technologies and management skills. Previously developed set of electives attempt to establish a uniform level of knowledge on RUE. This is to a great extent happening with success.

The detailed programme has been prepared in coordination between WB and EU partners, based on specific areas of interest, expressed by WB partners and by assessing the level of knowledge and skills featured by the prospective students. Joint working-groups, composed of lecturers in similar discipline from WB and EU partners, have worked during the project meetings but also in bilateral meeting, to draft and then finalize the course outlines. Each WB partner university is free to add to its syllabus some topics of its choice, as long as the learning outcomes are respected. Special set of electives will be developed for masters to continue with the improvement of their skills in the rapidly changing field of RUE. A workshop will be organized at the beginning of the second project year dedicated to these issues.

Some of the selected topics required for the project needs are being realized by EU partners specialized in the corresponding field. Selection of teaching staff from EU partner universities will be carefully planned. They will be involved in the specific subjects lecturing at master study programme at WB partner universities. Intensive, compressed courses (30 hours of lectures in 1 week's time) have been delivered by EU experts in WB partner universities, mainly in Novi Pazar, so as to complement the teachers' training scheme.

Retrained teaching staff have been included in the lecturing process at WB universities in the third project year and are engaged as mentors during the master thesis preparation. As a special form of rewards and stimulation for students which show best evaluated results, student's internship will be organized in EU countries with covering of basic costs of travel and stay using project funds. The mobility of the selected best students to EU universities is planned at 5 weeks summer seminars which will be validated with 6 ECTS. Furthermore, students have had independent research visits to EU universities, working on projects and specific research tasks.

Quality control of master programme study is conducted regularly and systematically through self-assessment and external verification of quality. At the beginning of the project realization the expert counsel was established from 6 WB partner universities members and 2 members from EU partners. It is also within this frame that the mandate for this report was given.

Quality control and monitoring of project activities and results is performed continuously throughout the whole duration of the project. These activities are being done in coordination and close cooperation with the quality assurance offices of consortium members and also by senior researchers from those universities. This process has been carried out (and is being carried out) at a constant pace. To assure quality control and monitoring, creating of written documents about every project activity will be performed in accordance with the best practice and quality plan, designed according to ISO 9001:2008. Different aspects of QA in this project are controlled and monitored, like in this very specific report, in order to keep track of the quality of outcomes, of the stakeholders' and users' satisfaction with the obtained results, of the quality of management and of the financial management. It is also within this frame that the peer review of the teaching material is taking place. Necessary questionnaires for the students, teaching staff, stakeholders related to the QA of ENERESE programme have been developed by expert counsel in coordination with QA offices at WB partner universities and are used during and after the course. Statistical assessment of the questionnaires is being done by QA office of WB partners.

Representatives from partner institutions carry out the everyday monitoring of work plan realization in the close cooperation with the contact person of applicant organization,

Students' Parliament, as well as with the representatives of non academic organizations and building societies. All deliverables will be evaluated, their quality tracked and improved if it is necessary. Those activities will be coordinated at experts counsel and coordination meetings.

4. Lectures and educational material used

The lectures presented by selected teaching staff have been the following:

4.1. Lectures presented by Prof. Jan Bongaerts from TUBF covering the topics of

- 1.1. Economics of renewable energy
- 1.2 Regelenergie
- 1.3 Renewable energy in Deutschland: an economic evaluation
- 1.4 Energy from renewable sources in mature markets

The lectures focused on economy and investments (macroeconomics, capital cost, debt and equity structure, inflation, fiscal policy), economic evaluation tools, operation and finances of renewable energy sources in mature markets etc.

The material contains state of the art knowledge and is of high quality, with the necessary degree of detail, yet at the same comprehensive and attractive.

4.2. Lectures presented by the academic staff from UNIZA

- 2.1 Jan Bujnak : Biomass utilisable for energy purposes
- 2.2 P. Bracník : Energy Monitoring and System Control
- 2.3 Marek Höger: Use of Wind and Solar Energy

The lectures focused on energy monitoring systems, biomass perspectives as well as wind and solar energy and the respective markets.

The material is well structured, with abundant information and presented in a very comprehensive way.

4.3. Lectures presented by Dr. E. Giama, Aristotle University Thessaloniki

The lectures covered a broad set of Environmental Economics issues in order to provide students with an insight into the subject.

4.3.1. Integrated energy planning referring to economic features of an investment such as capital expenses, depreciation, revenues and expenses, cash flows, salvage values.

4.3.2 Investment appraisal methods for energy production and energy conservation investments (Net Present Value, Internal Rate of Return, Life Cycle Cost, Levelized Cost of Energy, Depreciated Payback Period).

4.3.3 Tools to promote energy policies and renewable energy sources (Feed in tariffs, Net metering, alternative subsidies' schemes).

4.3.4 Costing and pricing of energy (Fixed and variable cost of power generation, sensitivity analysis, break even point).

4.4. Lectures presented by Mr. Bojan Kovacic

4.1 Energy efficiency concepts part 1

4.2 Energy efficiency concepts part 2

The main concept of the presentation was the energy efficiency and management in EU and the national legislation's prospective. Life Cycle Analysis of energy projects, sustainability certification schemes and tools, large and small scale energy business structures, financing schemes (Banking, crowd funding etc), legal aspects of energy projects (Large scale building refurbishment and renovation schemes, district heating systems etc).

4.5. Lectures given by Prof. Sašo Medved and assist. Prof. Ciril Arkar

Course "Renewable and low-ex technologies for energy supply in highly energy efficient buildings" were given.

5.1 Regulations on energy efficiency of buildings

5.2 Examples of EEB elaboration

5.3 Energy efficiency, renewable energy and environmental impact

5.4 Use of solar and wind energy

5.5. Lecture notes in Heating Ventilation Air-Conditioning including the topics of:

Thermal comfort, Heat losses, Central heating systems, Heating loads determination, Air conditioning, Refrigeration, Domestic Hot Water, Optimization of HVAC systems, Determination of energy consumption for heating

The course provided a well-balanced insight into the topics of energy and buildings, by presenting the technological aspects in a concise and comprehensive way.

5. Evaluation and Observations – Strengths and Concerns

The training material modules are evaluated based on three main criteria the:

- Quality of Content
- Potential Effectiveness as a Teaching/Learning Tool
- Planning of the course

Quality of Content

This criteria describes two general elements about the content of the material — its validity and its significance. The content of the training material is characterized as accurate and reliable. It depicts the reality and it is up to date compared to other relevant information and resources. Its content is complete within the scope of the course providing the necessary information.

Potential Effectiveness as a Teaching/Learning Tool

The training material can be used as a methodology to solve “new” problems concerning energy efficiency and energy economics. The methodologies and tools presented are clearly described and compared so the student can choose the appropriate tool or methodology to solve the problems occur. The teaching style is not so innovative, it could characterized rather classic but it is focused on interaction between students and teachers, case studies, illustrated examples, overviews and summaries where is appropriate.

Planning of the sessions

The sessions of the training material are efficiently related and have clear aims and outcomes based on the scope of the master programme and the individual target of each session. The teaching methods were described as satisfactory and appropriate for the tasks presented. The sessions drawn to satisfactory conclusions and encourage further action.

A weak point of the session planning is the communication with students. The amount of new ideas, methodologies and terms provided is significant and difficult to be clearly understood. Some suggestions on this direction could be the redesign of the time schedule

increasing the teaching hours based on the sessions' degree of difficulty and the amount of material to be processed by the students.

6. Conclusions

Higher Education is one of the few “ industries” in the world where a single person, the teacher, can design, develop, deliver and assess the quality of a “product”, the student, with little oversight or supervision. To achieve and improve the quality in education integrated planning is needed towards continual improvement for the services provided. Created in 1987, the ISO 9000 family of standards defined an international *process* of quality management systems that ensure that products and services meet the needs of customers and stakeholders. The standards are published by the International Organization for Standardization- ISO – and are distributed through national standards bodies. The target is to gain confidence of students, to encourage creativity, to improve services continually, to achieve students' delight and global competitiveness. What is necessary to include in the organisation's procedures is:

- a specific quality policy with defined quality objectives,
- guidelines for conduct teaching / orientation of the proposed teaching programme,
- processes for controlling and improving support services such as review, meetings, library management, equipment, maintenance,
- monitoring and auditing.

Finally, feedback from students is an essential quality control indicator providing information about teaching performance, teaching methodology, library resources and services and IT infrastructure.

Based on the overall impression obtained from analyzing the educational packages, the project has succeeded in the goals set and has established a maturity that can ensure its sustainability.

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