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Capacity Building in Higher Education

NEW ENERGY COMPETENCE SYSTEM AND TECHNOLOGY FOR WB ENERGY STABILITY SYSTEM CURRICULUM REFORM

(NEST4WB)

THE LEARNING MATERIAL HAS BEEN PREPARED

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Leposavić, 2024

www.nest4wb.akademijakm.edu.rs

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Executive Summary

The NEST4WB project has modernized curricula in the Western Balkans by preparing high-quality course materials and adopting innovative teaching methods. Traditional methods such as lectures and labs are complemented by modern approaches including project-based learning, flipped classrooms, simulations, and industry collaboration, as well as gamified learning, living labs, and learning factories.

By aligning each course with the most appropriate teaching method(s), the project ensures that students gain both theoretical knowledge and practical competencies. This blended approach fosters employability, strengthens academia-industry links, and equips graduates to drive the digital and sustainable energy transition in the Western Balkans. This consolidated report provides two complementary dimensions: first, the description of course materials and the mapping of teaching methods to ensure competence-based learning; second, the instructor manual offering practical, step-by-step guidance for effective implementation of these methods. Together, these elements ensure consistent and engaging teaching practices, strengthen academia-industry links, and prepare graduates to drive the digital and sustainable energy transition in the Western Balkans.

Due to space limitations, course materials are not integrated into this report; instead, the link to the course materials on the projects' website is provided: Learning Material – NEST4WB.

To access the materials, please use the following credentials:

Username: PO

Password: PO+2024

Part I: Course Materials and Teaching Methods

1. Introduction

The NEST4WB project is a regional initiative designed to modernize higher education programs in the Western Balkans in line with the European Green Deal, REPowerEU, and the digital transformation of the energy sector. A major outcome of Work Package 3 (WP3) is the development and preparation of course materials, together with the identification of suitable teaching methods for their delivery.

This integrated report combines two essential elements:

1. The preparation of new and updated course materials, based on standardized methodologies and partner collaboration.
2. The identification of effective teaching methods to ensure competence-based learning, employability, and alignment with modern educational trends.

By integrating these two dimensions, the NEST4WB consortium ensures that curricula modernization is supported both by high-quality academic content and by innovative pedagogical approaches.

2. Course Materials Preparation

The process of course material preparation followed a standardized and collaborative methodology. Courses were grouped into six thematic clusters, and each was developed using a common template to ensure consistency. Partner institutions contributed based on their areas of expertise, and all content underwent peer review and formatting.

The methodology included:

- Clustering of courses into thematic areas.

- Use of a standardized course template (objectives, theory, tools, case studies, glossary).

- Development of new content and adaptation of existing material.

- Peer review and final packaging as PDFs and interactive eBooks.

2.1 Partner Contributions

Each partner university contributed to the preparation of course materials in line with their study programs and national priorities. Highlights include:

- AASKM (Kosovo and Metohija): Developed materials for *Smart Energy Grids*, *Communications Systems, Cybersecurity Systems*, and *Environmental Protection and Safety*.

- LRS (Albania): Updated ICT-related courses and introduced Smart Grid Technology.

- UPKM (Kosovo): Modernized traditional electrical engineering courses such as Power Plants and Low-voltage Installations.

- USB (Bosnia and Herzegovina): Developed materials for Integration of Renewable Energy Sources and IoT Infrastructure in Smart Grids.

- SUM (Bosnia and Herzegovina): Prepared renewable energy courses such as Photovoltaic Power Plants and Smart Wind Systems.

- UES (Bosnia and Herzegovina): Developed courses on Microgrids, Electric Vehicles in Smart Grids, and Digital Relay Protection.

- UMT (Albania): Contributed a comprehensive MSc curriculum including Energy Economics, Energy Policy, and Climate Change & Renewable Energy.

- FPRN (Montenegro): Updated Electrical Engineering, Robotics and Automation, and Analog Electronics with simulations and AI applications.

2.2 Course Materials Table

Due to space limitations, course materials are not integrated into this report; instead, the link to the course materials on the projects' website is provided: Learning Material – NEST4WB.

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In Table 1, the titles of courses developed or modified—together with the institution that prepared the learning materials—are provided.

Table 1. Titles of developed or modified courses, with the institution that prepared the learning materials.

Course Title	Course materials developed by
Electrical Engineering	FPRN
Electrical Machines 3	UPKM
Electrical Measurements 2	UPKM
Low-voltage Electrical Installations	UPKM
Power Plants	UPKM
Analog Electronics	FPRN
Digital Relay Protection	UES
Smart Energy Grids	AASKM
Smart Grid Technology	LRS

Smart Systems for Measurement and Monitoring in Power Grids	USB
Power Systems Substations (Distribution Plants)	UPKM
Microgrids	UES
Electric Vehicles in Smart Grids	UES
Integration of Renewable Energy Sources into the Electrical Grid	USB
Measurement and Monitoring Systems in Smart Grid	UES
IoT Infrastructure in Smart Power Grids	USB
Renewable Energy Sources	SUM
Photovoltaic Power Plants	SUM
Smart Wind Energy Systems and Grid Integration	SUM
Fundamentals of Renewable Energy Technologies	UMT
Sustainable Development & Environmental Impact	UMT
Solar Thermal Technologies	UMT
Geothermal Energy Systems	UMT
Hydropower Engineering & Management	UMT
Wind Energy Development	UMT
Energy Systems & Grid Integration	UMT
Project Management in Engineering	AASKM
Project Management for Renewable Energy	UMT
Introduction to Project Management	LRS
Energy Economics & Market Analysis	UMT
Energy, Policy and EU Regulation	UMT
Energy Efficiency & Demand-side Management	UMT
Electricity market	UES
Energy Data Analytics & Visualisation	UMT
Renewable Energy Entrepreneurship	UMT
Sustainable Urban Energy Systems	UMT
Communication Systems	AASKM
Modern Computer Networks	USB

Management and Control Systems	AASKM
Monitoring and Diagnostics of High-Voltage Equipment	AASKM
Cybersecurity Systems	AASKM
Security and Risks of Information Systems	LRS
Introduction to the Theory of Databases	LRS
Software Modeling of Solar and Wind Energy Use	USB
Data Structures and Algorithms	FPRN
Robotics and Automation	FPRN
Mathematics and Statistics for Energy Management	UMT
Environmental Protection and Safety	UMT
Research Methods in Renewable Energy	UMT
Climate Change & Renewable Energy	UMT

3. Teaching Methods for NEST4WB Courses

The following sections provide detailed descriptions of the teaching methods considered for NEST4WB, outlining advantages, limitations, and justifications for their application to specific courses.

Lecture-Based Teaching

Structured presentation of knowledge by the instructor, the backbone of higher education, especially in technical subjects.

Advantages:

- Efficient for large groups.

- Standardized delivery across institutions.

Limitations:

- Passive learning, low engagement.

- Limited skill development.

Best for foundational courses (e.g., Electrical Engineering, Mathematics, Renewable Energy Sources).

Laboratory and Practical Sessions

Hands-on experimentation in physical or digital labs, reinforcing theory with practice.

Advantages:

- Strengthens understanding through application.

- Develops practical skills essential for employability.

Limitations:

- Costly in terms of equipment and maintenance.

- Limited scalability for large cohorts.

Ideal for technical courses (e.g., Photovoltaic Power Plants, Robotics and Automation, Communication Systems).

Project-Based Learning (PBL)

Students work in interdisciplinary teams on projects simulating real-world challenges.

Advantages:

- Encourages teamwork, creativity, problem-solving.

- Strong industry alignment.

Limitations:

- Supervision-intensive and time demanding.

- Complex to assess.

Suited for Smart Energy Grids, Project Management, and Renewable Energy Entrepreneurship.

Case Study Method

Analysis of real-world problems from industry, markets, or regulation.

Advantages:

- Builds critical thinking and analytical skills.

- Connects theory with real practice.

Limitations:

- Dependent on case availability.

- May lack technical depth.

Effective in Energy Economics, Cybersecurity, and Sustainable Urban Energy Systems.

Flipped Classroom

Students prepare content independently (videos, readings) and use class time for active tasks.

Advantages:

- Promotes active learning.

- Maximizes interactive class time.

Limitations:

- Requires motivated students.

- Needs strong digital infrastructure.

Useful for Smart Grid Technology, Research Methods, and Project Management.

Problem-Based Learning (PrBL)

Students learn through solving open-ended problems in small groups.

Advantages:

- Enhances independence, reasoning, and collaboration.

- Deepens conceptual understanding.

Limitations:

- Requires skilled facilitation.

- Can challenge students used to lectures.

Appropriate for Electrical Machines 3, Cybersecurity, and Smart Grid Measurement.

Simulation and Digital Tools

Use of specialized software to replicate real-world energy systems safely and cost-effectively.

Advantages:

- Safe experimentation environment.

- Industry-relevant and scalable.

Limitations:

- Requires licenses and training.

- Less tactile than physical labs.

Essential in Smart Energy Grids, Microgrids, Smart Wind Systems, and Power Plants.

Internships and Industry Collaboration

Structured placements or joint projects with companies.

Advantages:

- Provides authentic workplace experience.

- Strong employability outcomes.

Limitations:

- Dependent on external partnerships.

- Variable quality of placements.

Critical for Energy Systems, Renewable Energy Entrepreneurship, and Professional Practice.

Gamified Learning

Integration of game mechanics (points, challenges, leaderboards) into learning activities.

Advantages:

- Boosts motivation and engagement.

- Provides immediate feedback and fosters competition.

Limitations:

- Risk of superficial learning if poorly designed.

- Focus may shift to rewards rather than content.

Relevant for Cybersecurity Systems, Data Structures, and Renewable Energy Entrepreneurship where iterative practice and decision-making are key.

Living Labs

Real-life environments where students, industry, and communities co-create and test solutions.

Advantages:

- Provides authentic experience.

- Encourages collaboration with multiple stakeholders.

Limitations:

- Complex to organize and sustain.

- Requires strong partnerships.

Suitable for Smart Energy Grids, Microgrids, and Sustainable Urban Energy Systems, enabling students to engage directly with real users and stakeholders.

Learning Factories

Practice-oriented environments simulating industrial processes for hands-on experience.

Advantages:

- Realistic training environment.

- Strong link to industry processes and optimization.

Limitations:

- High investment required.

- Needs regular updates.

Applicable to Robotics and Automation, Management and Control Systems, and Energy Efficiency & Demand-Side Management for industrially relevant learning.

A summary of the teaching methods (pros and cons) is presented in Table.

Table 2. Summary of Teaching Methods

Teaching Method	Pros	Cons
Lecture-Based Teaching	Efficient for covering large amounts of theory; Structured and easy to plan; Works well for large groups	Passive learning; Limited student engagement; May not develop practical skills
Laboratory and Practical Sessions	Hands-on experience; Reinforces theory with practice; Builds technical competence	Resource-intensive (labs, equipment); Time-consuming; Limited scalability

Project-Based Learning (PBL)	Encourages critical thinking and problem-solving; Promotes teamwork and creativity; Closer to real-world challenges	Requires strong facilitation; Can be difficult to assess; Uneven participation in groups
Case Study Method	Connects theory with real-world applications; Develops analytical and decision-making skills; Encourages discussion	Case availability may be limited; Time-intensive; May oversimplify complex issues
Flipped Classroom	Increases active learning; Frees class time for problem-solving and discussions; Supports self-paced learning	Requires high student preparation; Dependent on quality of pre-class materials; Technology access needed
Problem-Based Learning (PrBL)	Promotes deep understanding and independent learning; Develops problem-solving and research skills	Students may struggle without guidance; More time needed compared to lectures; Instructor must act as facilitator
Simulation and Digital Tools	Safe testing environment; Visualizes complex systems; Scalable and repeatable	High cost of software/hardware; Learning curve for tools; May oversimplify reality
Internships and Industry Collaboration	Real-world exposure; Improves employability; Builds industry connections	Availability depends on partners; Unequal student access; Hard to standardize learning outcomes
Gamified Learning	Increases motivation and engagement; Makes learning interactive and fun; Encourages competition and collaboration	Risk of focusing on fun over learning; Design complexity; Not suitable for all subjects
Living Labs	Real-world experimentation; Involves multiple stakeholders; Encourages innovation and applied research	Complex to organize; Requires external collaboration; May have unpredictable outcomes
Learning Factories	Immersive environment; Combines theory with industrial practice; Strong employability impact	Expensive to establish; Needs ongoing industry partnerships; Limited scalability

3.1 Course-to-Method Mapping with Justifications

Table 3. Course-to-Method Mapping with Justifications

Course Title	Suggested Teaching Methods	Justification
Electrical Engineering	Lecture-Based Teaching, Project-Based Learning (PBL)	Provides foundational knowledge through lectures and promotes applied understanding through projects.
Electrical Machines 3	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Theoretical understanding supported with lab experiments and simulations for machine operation and performance.
Electrical Measurements 2	Lecture-Based Teaching, Laboratory and Practical Sessions, Problem-Based Learning (PrBL)	Students need strong theoretical grounding and hands-on experience with instruments, applying problem-solving scenarios.
Low-voltage Electrical Installations	Lecture-Based Teaching, Laboratory and Practical Sessions, Case Study Method	Practical training is essential for wiring, protection, and safety standards reinforced by case analyses.
Power Plants	Lecture-Based Teaching, Case Study Method, Internships and Industry Collaboration	Theoretical overview combined with case-based analysis of plant operations and direct exposure through internships.
Analog Electronics	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Circuit theory explained through lectures, validated in lab and simulations for component behavior.
Digital Relay Protection	Lecture-Based Teaching, Simulation and Digital Tools, Case Study Method	Understanding protection schemes through theory, simulated faults, and real-world case studies.
Smart Energy Grids	Lecture-Based Teaching, Project-Based Learning (PBL), Simulation and Digital Tools, Internships and Industry Collaboration	Combines theoretical framework with digital grid models, practical projects, and exposure to industry practices.

Smart Grid Technology	Lecture-Based Teaching, Flipped Classroom, Simulation and Digital Tools, Project-Based Learning (PBL)	Active learning enhanced by pre-class materials, in-class problem solving, and use of digital tools for design projects.
Smart Systems for Measurement and Monitoring in Power Grids	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Integration of monitoring technologies requires both conceptual teaching and practical demonstrations with software tools.
Power Systems Substations (Distribution Plants)	Lecture-Based Teaching, Laboratory and Practical Sessions, Case Study Method	Covers theoretical aspects of substations with lab exercises and case-based operational scenarios.
Microgrids	Lecture-Based Teaching, Project-Based Learning (PBL), Simulation and Digital Tools, Living Labs	Microgrids benefit from practical projects, simulations, and real-world Living Lab demonstrations.
Electric Vehicles in Smart Grids	Lecture-Based Teaching, Project-Based Learning (PBL), Simulation and Digital Tools, Industry Collaboration	EV integration requires theoretical grounding, practical projects, simulation of charging systems, and industry input.
Integration of Renewable Energy Sources into the Electrical Grid	Lecture-Based Teaching, Project-Based Learning (PBL), Case Study Method, Simulation and Digital Tools	Students analyze integration challenges via projects, simulations, and real-world case studies.
Measurement and Monitoring Systems in Smart Grid	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Requires theoretical knowledge and lab-based validation of monitoring systems with software tools.
IoT Infrastructure in Smart Power Grids	Lecture-Based Teaching, Project-Based Learning (PBL), Laboratory and Practical Sessions	Covers IoT frameworks with practical labs and projects for applied skills.
Renewable Energy Sources	Lecture-Based Teaching, Case Study Method, Project-Based Learning (PBL)	Theory supplemented with case studies of renewable deployment and student-driven projects.

Photovoltaic Power Plants	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools, Industry Collaboration	Combines classroom theory with lab experiments, PV simulation tools, and site visits.
Smart Wind Energy Systems and Grid Integration	Lecture-Based Teaching, Simulation and Digital Tools, Case Study Method	Students gain insights into wind energy control via simulation and real project case studies.
Fundamentals of Renewable Energy Technologies	Lecture-Based Teaching, Flipped Classroom, Project-Based Learning (PBL)	Active participation supported by flipped classroom discussions and applied projects.
Sustainable Development & Environmental Impact	Lecture-Based Teaching, Case Study Method, Problem-Based Learning (PrBL)	Students explore environmental impacts through cases and problem-driven analysis.
Solar Thermal Technologies	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Understanding solar thermal processes requires theoretical foundations and lab-scale demonstration.
Geothermal Energy Systems	Lecture-Based Teaching, Case Study Method, Simulation and Digital Tools	Theoretical geothermal principles reinforced by real-world case studies and design simulations.
Hydropower Engineering & Management	Lecture-Based Teaching, Case Study Method, Industry Collaboration	Covers hydropower fundamentals, analyzed via real case studies and industry cooperation.
Wind Energy Development	Lecture-Based Teaching, Project-Based Learning (PBL), Case Study Method	Learning reinforced through real case studies and development-oriented projects.
Energy Systems & Grid Integration	Lecture-Based Teaching, Simulation and Digital Tools, Project-Based Learning (PBL)	Integration challenges studied via simulations and project design exercises.
Project Management in Engineering	Lecture-Based Teaching, Case Study Method, Project-Based Learning (PBL)	Combines theoretical project frameworks with case-based analysis and student projects.

Project Management for Renewable Energy	Lecture-Based Teaching, Case Study Method, Project-Based Learning (PBL)	Focuses on renewable-specific project issues via projects and cases.
Introduction to Project Management	Lecture-Based Teaching, Case Study Method, Project-Based Learning (PBL)	Basic concepts covered in class with applied projects and cases.
Energy Economics & Market Analysis	Lecture-Based Teaching, Case Study Method, Problem-Based Learning (PrBL)	Economic analysis explored via real-world market case studies and problem-driven exercises.
Energy, Policy and EU Regulation	Lecture-Based Teaching, Case Study Method, Flipped Classroom	Students analyze regulatory frameworks through pre-class reading and in-class case analysis.
Energy Efficiency & Demand-side Management	Lecture-Based Teaching, Project-Based Learning (PBL), Case Study Method	Efficiency measures studied in cases and projects applying real-world DSM strategies.
Energy Data Analytics & Visualisation	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Requires technical skill-building through labs and software-based analytics.
Renewable Energy Entrepreneurship	Lecture-Based Teaching, Project-Based Learning (PBL), Case Study Method	Supports innovation skills by combining theory with entrepreneurship projects and case analyses.
Sustainable Urban Energy Systems	Lecture-Based Teaching, Living Labs, Project-Based Learning (PBL)	Urban systems best explored via Living Labs and applied projects with stakeholders.
Communication Systems	Lecture-Based Teaching, Laboratory and Practical Sessions, Simulation and Digital Tools	Concepts supported by practical labs and simulation of communication systems.
Modern Computer Networks	Lecture-Based Teaching, Laboratory and Practical Sessions, Problem-Based Learning (PrBL)	Networking principles reinforced through labs and problem-driven case setups.

Management and Control Systems	Lecture-Based Teaching, Simulation and Digital Tools, Project-Based Learning (PBL)	Control systems applied in projects and validated through simulation.
Monitoring and Diagnostics of High-Voltage Equipment	Lecture-Based Teaching, Laboratory and Practical Sessions, Case Study Method	Lab-based diagnostics paired with real case examples.
Cybersecurity Systems	Lecture-Based Teaching, Laboratory and Practical Sessions, Problem-Based Learning (PrBL)	Practical cybersecurity skills developed via labs and scenario-driven problems.
Security and Risks of Information Systems	Lecture-Based Teaching, Case Study Method, Problem-Based Learning (PrBL)	Covers IT risks through real cases and problem-oriented study.
Introduction to the Theory of Databases	Lecture-Based Teaching, Laboratory and Practical Sessions, Project-Based Learning (PBL)	Database principles reinforced with lab implementation and student projects.
Software Modeling of Solar and Wind Energy Use	Lecture-Based Teaching, Simulation and Digital Tools, Project-Based Learning (PBL)	Students build and analyze renewable models through simulations and projects.
Data Structures and Algorithms	Lecture-Based Teaching, Laboratory and Practical Sessions, Problem-Based Learning (PrBL)	Algorithmic thinking supported with coding labs and problem-solving tasks.
Robotics and Automation	Lecture-Based Teaching, Laboratory and Practical Sessions, Project-Based Learning (PBL), Gamified Learning	Practical robotics labs, project integration, and gamification enhance creativity and engagement.
Mathematics and Statistics for Energy Management	Lecture-Based Teaching, Problem-Based Learning (PrBL), Flipped Classroom	Theoretical learning enhanced with flipped practice and applied problem-solving.
Environmental Protection and Safety	Lecture-Based Teaching, Case Study Method, Project-Based Learning (PBL)	Students address safety and sustainability via real cases and practical projects.

Research Methods in Renewable Energy	Lecture-Based Teaching, Project-Based Learning (PBL), Case Study Method	Focuses on applied research skills developed through projects and case analyses.
Climate Change & Renewable Energy	Lecture-Based Teaching, Case Study Method, Project-Based Learning (PBL)	Explores global challenges via real cases and student projects.

The inclusion of gamified learning, living labs, and learning factories enriches the pedagogical landscape of NEST4WB. These innovative approaches increase student engagement, connect learning to real-world environments, and provide industry-level practice. They complement traditional and modern methods, ensuring a balance of theoretical grounding, practical application, and professional exposure. Together, they prepare students not only for immediate employment but also for innovation and leadership roles in the energy transition. By integrating traditional, modern, and innovative teaching methods, NEST4WB ensures that students develop comprehensive competencies. The mapping of methods to courses provides clear guidance for educators and guarantees relevance to industry needs. The combination of course materials and diversified pedagogy strengthens higher education institutions, fosters regional integration, and builds a workforce ready to lead the Western Balkans into a sustainable and digital energy future.

Part II: Instructor Manual

1. Introduction

This Instructor Manual supports faculty members in applying diverse teaching methods across NEST4WB courses. It explains when each method is best used, implementation steps, instructor and student roles, assessment strategies, resources, and alignment with NEST4WB courses. By following this guidance, instructors will ensure consistent, engaging, and effective teaching practices.

2. Teaching Methods Guide

Lecture-Based Teaching

Extended Description: Structured instructor-led sessions to deliver theoretical knowledge in a systematic way.

When to Use:

- Introducing new concepts and theories.
- Explaining frameworks, equations, or regulations.
- Large-group teaching.

Implementation Steps:

- Structure lecture in 15–20 min segments.
- Use multimedia aids (diagrams, videos, simulations).
- Include interactive breaks (polls, questions).
- Provide lecture notes in advance.

Instructor Role: Primary knowledge transmitter and facilitator of discussions.

Student Role: Listeners, note-takers, active participants in Q&A.

Assessment Approaches:

- Quizzes on lecture content.
- Short reflection assignments.
- Exams testing conceptual understanding.

Resources & Tools:

- Slides, whiteboard, polling tools (Mentimeter, Kahoot).

Best Fit Courses: Electrical Engineering Fundamentals, Energy Economics, Renewable Energy Sources.

Laboratory and Practical Sessions

Extended Description: Hands-on experiments in physical or virtual labs to reinforce theoretical knowledge.

When to Use:

- Teaching measurement and operational skills.

- Demonstrating technical processes.

- Training on specific tools/software.

Implementation Steps:

- Provide pre-lab reading.

- Define objectives and safety protocols.

- Facilitate group experiments.

- Require lab reports with analysis.

Instructor Role: Supervisor, safety monitor, evaluator.

Student Role: Experimenters, problem-solvers, report writers.

Assessment Approaches:

- Lab reports.

- Practical exams.

- Peer evaluation of teamwork.

Resources & Tools:

- Lab equipment (oscilloscopes, PV panels).

- Simulation software (MATLAB, PVSyst, SCADA emulators).

Best Fit Courses: Photovoltaic Power Plants, Robotics and Automation, Communication Systems.

Project-Based Learning (PBL)

Extended Description: Students collaborate on interdisciplinary projects simulating real-world challenges.

When to Use:

- Interdisciplinary integration is needed.
- Practical application of theory.
- Developing teamwork and leadership.

Implementation Steps:

- Define project scope and milestones.
- Assign teams and roles.
- Provide regular feedback.
- Evaluate outputs via reports/presentations.

Instructor Role: Project supervisor, mentor, evaluator.

Student Role: Collaborators, innovators, project managers in training.

Assessment Approaches:

- Project reports.
- Oral presentations.
- Peer/self-assessment.

Resources & Tools:

- Templates, collaboration tools (MS Teams, Trello).

Best Fit Courses: Smart Energy Grids, Project Management, Renewable Energy Entrepreneurship.

Case Study Method

Extended Description: Students analyze real-world cases, identify problems, and propose solutions.

When to Use:

- Understanding context-driven issues.
- Linking theory with practice.
- Fostering decision-making skills.

Implementation Steps:

- Distribute case study materials.
- Pose guiding questions.
- Facilitate group discussion.
- Have students present findings.

Instructor Role: Facilitator, discussion leader.

Student Role: Analysts, debaters, problem-solvers.

Assessment Approaches:

- Case analysis reports.
- Participation.
- Presentations.

Resources & Tools:

- Case libraries, industry reports.

Best Fit Courses: Energy Economics & Market Analysis, Cybersecurity Systems, Sustainable Urban Energy Systems.

Flipped Classroom

Extended Description: Students study materials before class; class time is used for problem-solving and discussions.

When to Use:

- Maximizing interactive time.
- Courses with strong theory-to-practice potential.
- Self-directed learning contexts.

Implementation Steps:

- Assign pre-class videos/readings.
- Conduct in-class exercises.
- Assess preparation with quizzes.
- Facilitate debates and problem-solving.

Instructor Role: Facilitator of applied learning.

Student Role: Independent learners, active participants in class.

Assessment Approaches:

- Pre-class quizzes.
- Class exercises.
- Participation.

Resources & Tools:

- LMS, video lectures, readings.

Best Fit Courses: Smart Grid Technology, Research Methods, Project Management.

Problem-Based Learning (PrBL)

Extended Description: Students solve open-ended problems in small groups with guidance from instructors.

When to Use:

- Complex problems with multiple solutions.
- Promoting critical thinking.
- Encouraging self-directed learning.

Implementation Steps:

- Present complex problem.
- Guide brainstorming sessions.
- Support group research.
- Review and critique solutions.

Instructor Role: Facilitator, guide, mentor.

Student Role: Investigators, team members, problem-solvers.

Assessment Approaches:

- Problem solution reports.
- Group presentations.
- Peer evaluation.

Resources & Tools:

- Problem scenarios, digital libraries.

Best Fit Courses: Cybersecurity Systems, Electrical Machines 3, Smart Grid Measurement.

Simulation and Digital Tools

Extended Description: Students use specialized software to simulate and analyze energy systems.

When to Use:

- Real experiments are costly or unsafe.
- Teaching industry-standard tools.

- Scenario analysis and optimization.

Implementation Steps:

- Introduce software basics.
- Assign simulation scenarios.
- Facilitate comparison and reflection.

Instructor Role: Trainer, facilitator of digital skills.

Student Role: Simulation operators, analysts, interpreters.

Assessment Approaches:

- Simulation reports.
- Assignments.
- Practical exams.

Resources & Tools:

- MATLAB/Simulink, PVSyst, HOMER, SCADA emulators.

Best Fit Courses: Smart Energy Grids, Microgrids, Wind Systems, Power Plants.

Internships and Industry Collaboration

Extended Description: Students gain practical exposure through company placements or joint projects.

When to Use:

- Developing professional skills.
- Networking with industry.
- Real-world application of knowledge.

Implementation Steps:

- Establish agreements with companies.
- Define outcomes.
- Monitor progress and collect feedback.
- Evaluate with reports and employer reviews.

Instructor Role: Coordinator, supervisor.

Student Role: Interns, collaborators, reflective practitioners.

Assessment Approaches:

- Internship report.
- Employer evaluation.
- Reflection journals.

Resources & Tools:

- Partnership agreements.
- Supervision guidelines.

Best Fit Courses: Energy Systems, Renewable Energy Entrepreneurship, Professional Practice.

Gamified Learning

Extended Description: Incorporates game elements (points, challenges, leaderboards) into education.

When to Use:

- Repetitive or iterative practice needed.
- Engagement in competitive contexts.
- Decision-making exercises.

Implementation Steps:

- Define challenges and scoring rules.
- Integrate into class activities or digital platforms.
- Reward learning achievements.

Instructor Role: Game designer, facilitator.

Student Role: Competitors, learners, team players.

Assessment Approaches:

- Scores in gamified tasks.
- Learning reflections.
- Progress tracking.

Resources & Tools:

- Kahoot, Quizizz, custom games.

Best Fit Courses: Cybersecurity Systems, Data Structures, Renewable Energy Entrepreneurship.

Living Labs

Extended Description: Students, researchers, and stakeholders co-create solutions in real-world environments.

When to Use:

- Need for real-life engagement.
- Testing innovative solutions with communities.
- Collaboration with municipalities/companies.

Implementation Steps:

- Identify stakeholder problem.
- Organize student-stakeholder teams.
- Develop and test solutions.
- Reflect and evaluate outcomes.

Instructor Role: Coordinator, facilitator of partnerships.

Student Role: Innovators, applied researchers.

Assessment Approaches:

- Project reports.
- Stakeholder feedback.
- Presentations.

Resources & Tools:

- Partnerships with industry/municipalities.

Best Fit Courses: Smart Energy Grids, Microgrids, Sustainable Urban Energy Systems.

Learning Factories

Extended Description: Simulated industrial environments for students to learn-by-doing.

When to Use:

- Bridging academia and industry.
- Training on industrial processes.
- Developing managerial and technical skills.

Implementation Steps:

- Provide industrial setup or digital twin.

- Assign challenges (optimize, troubleshoot).

- Rotate student roles (operator, manager, analyst).

Instructor Role: Supervisor, evaluator.

Student Role: Operators, decision-makers, managers.

Assessment Approaches:

- Performance tasks.

- Process optimization outcomes.

- Reports.

Resources & Tools:

- Learning factory setups, digital twins.

Best Fit Courses: Robotics, Control Systems, Energy Efficiency & Demand-Side Management.

3. Instructor Checklist

To ensure high-quality and consistent delivery of NEST4WB courses, instructors are advised to follow the checklist below:

- Align selected teaching methods with clearly defined course learning outcomes.
- Prepare all instructional resources and digital tools well in advance of course delivery.
- Actively foster student participation and engagement throughout the learning process.
- Employ a variety of assessment strategies to evaluate both knowledge acquisition and skill development.
- Systematically gather feedback from students and industry stakeholders to inform continuous improvement.
- Integrate theoretical content with practical applications through case studies, laboratory work, and real-world scenarios.
- Enrich teaching by incorporating relevant industry examples and inviting guest lecturers where feasible.
- Design learning activities that promote teamwork, collaboration, and peer-to-peer interaction.
- Recognize and accommodate diverse learning styles—including visual, analytical, and kinesthetic approaches.
- Ensure that all teaching materials and activities are inclusive and accessible to all learners.
- Encourage student self-reflection and implement structured peer evaluation mechanisms.

- Document challenges encountered and successful strategies employed to support iterative course enhancement.

The Instructor Manual offers a comprehensive and practice-oriented guide for implementing diverse teaching methods within the NEST4WB curriculum. When applied effectively, these strategies enable instructors to deliver both robust theoretical content and hands-on practical experience, thereby preparing students to meet the demands of the digital and sustainable energy transition.

Discussion

The integrated framework presented in this report illustrates how the convergence of course materials, innovative teaching methodologies, and structured instructor support forms a comprehensive and sustainable model for educational reform. The inclusion of advanced pedagogical strategies—such as gamified learning, living labs, and learning factories—enriches traditional and modern teaching by immersing students in dynamic, real-world learning environments. These approaches foster deeper engagement, experiential understanding, and stronger alignment with industry practices.

Crucially, the Instructor Manual operationalizes this framework by offering educators clear, systematic guidance on the application of each teaching method. It outlines the appropriate contexts for use, clarifies the respective roles of instructors and students, and recommends tailored assessment strategies. This structured support ensures that pedagogical innovation is not ad hoc but deliberate, scalable, and consistent across partner institutions.

Together, these components address key challenges often encountered in higher education, including student passivity, limited practical exposure, and insufficient industry linkage—while promoting critical thinking, innovation, and graduate employability. Through the strategic combination of academic rigor and practical instruction, the NEST4WB project lays a strong foundation for long-term curriculum modernization and education system resilience in the Western Balkans.

Conclusion

This consolidated report unites three essential pillar-course content, pedagogical methodology, and instructional guidance—into a cohesive model for transforming energy-related higher education in the Western Balkans. By integrating rich academic materials with modern, learner-centered teaching practices and a practical manual for faculty, the NEST4WB initiative ensures that students acquire both solid theoretical foundations and relevant, industry-ready skills.

This dual focus significantly enhances students' professional competence and employability, while also preparing them to lead and contribute meaningfully to the region's digital and sustainable energy transition. For educators, the report provides not only a strategic vision but also actionable steps that facilitate consistent, high-quality teaching across diverse institutional contexts.

Ultimately, this holistic and collaborative approach strengthens cross-border academic cooperation, aligns education with labor market needs, and promotes long-term sustainability in higher education reform. NEST4WB thus establishes a replicable model for capacity building that is both context-sensitive and future-oriented.

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CHECKLIST FOR REVIEW OF DELIVERABLE[1]

Project acronym:	**NEST4WB**
Project full title:	**NEW ENERGY COMPETENCE SYSTEM AND TECHNOLOGY FOR WB ENERGY STABILITY SYSTEM CURRICULUM REFORM**
Project No:	**101129321 (Call: ERASMUS-EDU-2023-CBHE)**
Coordinator institution:	**ACADEMY OF APPLIED STUDIES KOSOVO AND METOHIJA**
Coordinator:	**Phd Bojan Prlincevic,prof.a.s.**
Beneficiaries:	**SVEUCILISTE U RIJECI-TEHNICKI FAKULTET (UNIRI RITEH), Croatia** **ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON (NKUA), Greece** **VSB - TECHNICAL UNIVERSITY OF OSTRAVA (VSB - TUO), Czech** **UNIVERSIDAD POLITECNICA DE MADRID (UPM), Spain,** **AKADEMIJA TEHNICKO-VASPITACKIH STRUKOVNIH STUDIJA (AATPS), Serbia,** **AKADEMIJA TEHNICKO-UMETNICKIH STRUKOVNIH STUDIJA (ATUSS), Serbia,** **UNIVERSITY OF MITROVICA (UPKM), Kosovo *,** **UNIVERZITET U ISTOCNOM SARAJEVU (UES), Bosnia and Herzegovina,** **University of Mostar (SUM), Bosnia and Herzegovina,** **UNIVERZITET SINERGIJA BIJELJINA (USB), Bosnia and Herzegovina,** **LUARASI UNIVERSITY (LRS), Albania,** **UNIVERSITETI METROPOLITAN TIRANA (UMT), Albania,** **FAKULTET PRIMIJENJENE NAUKE PODGORICA (FPRN), Montenegro.**

[1] *This form has to be filled and to be returned to author of deliverable and WP leader, and to the coordinator, on e-mail address:* nest4wb@akademijakm.edu.rs..

WP3

Deliverable D3.3

ASSURANCE POINT	ISSUES TO BE ADDRESSED	ASSESSMENT	COMMENTS	RECCOMENDATIONS
Compiliance with NEST4WB objectives	*Does the deliverable comply with the overall objectives of the project?*	▶ yes		
Compiliance with the specfic objectives of the WP	*Does the deliverable comply with the WP Objectives as specified in the WP description?*	▶ yes		
Correspondence with the description of work of the relevant activity	*Does the deliverable correspond with the activity description as specified in the Application Form?*	▶ yes		
Compliance with the deliverables format	*Is the deliverable presented using the Project's deliverable format – Annex K*	▶ yes		
Adequacy of complementary information	*Examples of complementary info:* *- Sources used,* *- Bibliography,* *- List of contacts,* *- Methodology used.*	▶ yes		
Adequacy of written language	*Level of written English*	▶ adeguate		
Overall assessment and suggestions for improvement	**I consider the report to be appropriate.**			
Date of Quality Assurance performed by CQA ~~or EC~~ reviewer				
Deadline for submission of amended version of the Deliverable				

Reviewer signement:_____

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prof. Ing. Miroslav Vozňák, Ph.D.

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