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Capacity Building in Higher Education

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

(NEST4WB)

CREATING A TRAINING PROCEDURE INTENDED FOR ECONOMY

DELIVERABLE D3.4

~ draft ~

Project Number: 101129321

(Call: Erasmus-Edu-2023-CBHE)

Leposavić, 2025

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Disclaimer on the Use of AI Tools

AI tools were used to refine language, improve readability, and ensure coherence across sections, particularly in aligning terminology and formatting. All technical content, data, analysis, results, and conclusions remain the responsibility of the authors. The authors reviewed and validated the final text to ensure accuracy, originality, and compliance with project objectives.

Executive Summary

This deliverable consolidates the Laboratory Regulations and Operating Procedures developed within the NEST4WB project for laboratories that have been newly established or significantly upgraded at partner higher education institutions. The document constitutes a comprehensive regulatory and operational framework that governs the safe, effective, and sustainable use of advanced laboratory infrastructures supporting education and training in digitalized energy systems. It addresses all critical aspects of laboratory operation, including rules for access and supervision, occupational health and safety requirements, prevention of electrical, mechanical, and fire-related hazards, environmental protection measures, waste management procedures, emergency response and incident reporting, allocation of roles and responsibilities among laboratory users and staff, and formal mechanisms for periodic monitoring, review, and updating of the regulations.

The scope of the regulations extends across a diverse set of laboratory environments developed under the NEST4WB project. These include laboratories for simulation of remote monitoring and control of switchgear and power system components, renewable energy sources laboratories, laboratories dedicated to artificial intelligence and machine learning applications, additive manufacturing and 3D printing facilities, virtual reality laboratories, and electronics and energy systems laboratories. By covering this wide range of laboratory types, the document ensures a consistent and harmonized approach to laboratory governance across the consortium, while allowing for adaptation to institution-specific infrastructures and national legal frameworks.

The regulations ensure compliance with national occupational health and safety legislation and related regulatory requirements in each partner country and are aligned with relevant international and European standards, including ISO, IEC, and EN norms. This alignment enhances institutional credibility, supports quality assurance processes, and facilitates cross-institutional comparability and transferability of laboratory practices. By formalizing laboratory governance structures and operational procedures, the deliverable strengthens institutional capacity to manage complex laboratory environments, mitigates operational risks, and supports the professionalization of laboratory-based teaching and training activities.

From an educational perspective, the regulations play a critical enabling role by allowing the safe and systematic integration of hands-on laboratory activities into Bachelor and Master study programs, as well as into lifelong learning (LLL) courses targeting professionals and other non-traditional learners. Clear rules regarding access, supervision, training requirements, and user responsibilities ensure that laboratory activities can be conducted efficiently while maintaining high safety and quality standards. This directly supports curriculum modernization objectives and enhances the practical relevance of educational programs.

Within WP3, the laboratory regulations function not only as safety and governance instruments, but as the operational backbone of training procedures intended for economy, enabling structured delivery of practice-oriented education for students, professionals, and industry stakeholders.

Overall, this deliverable represents a foundational and strategic output of the NEST4WB project. By establishing clear, comprehensive, and transferable laboratory regulations, it underpins the long-term sustainability, replicability, and scaling of project results. The document enables continued use and further development of advanced laboratory infrastructures beyond the project lifetime, contributes to improved educational quality and employability, and supports institutional and regional capacity building in the field of digitalized energy systems across the Western Balkans.

Introduction

Within the **Erasmus+ Capacity Building in Higher Education (CBHE)** framework, the NEST4WB project addresses a strategic and systemic challenge faced by higher education institutions in the Western Balkans: the need to modernize educational provision in response to the rapid digitalization and increasing complexity of contemporary energy systems. The transition towards smart grids, distributed energy resources, digital monitoring and control platforms, and data-driven operation has fundamentally altered the competence profiles required of future engineers and energy professionals. As a result, higher education institutions must ensure that students and professionals acquire not only theoretical knowledge, but also practical experience in operating, analyzing, and managing complex, digitally enabled energy infrastructures.

In this context, **practice-oriented laboratory education** is a central pillar of curriculum modernization. Laboratories provide an environment in which learners can translate theoretical concepts into applied skills, develop technical confidence, and engage with real-world operational scenarios. However, the introduction of advanced laboratory infrastructures—particularly those involving electrical systems, renewable energy installations, digital control platforms, artificial intelligence tools, and cyber-physical systems—also introduces heightened levels of technical, organizational, and safety-related complexity. These environments involve significant risks, including electrical hazards, mechanical hazards, data security risks, equipment misuse, and operational disruptions, all of which must be systematically managed to ensure safe and effective learning.

While the acquisition of modern laboratory equipment and software platforms is a necessary foundation for addressing these educational needs, experience shows that infrastructure investment alone is insufficient to achieve sustainable educational impact. Without clearly defined and consistently enforced rules governing laboratory access, user responsibilities, supervision requirements, occupational health and safety measures, environmental protection, and emergency response, laboratory activities may expose users to unacceptable risks, compromise learning quality, and place institutions at risk of non-compliance with national legislation and internal quality assurance standards. Moreover, the absence of harmonized regulatory frameworks can lead to fragmented practices across departments and institutions, reducing the effectiveness and credibility of curriculum modernization efforts.

The **Laboratory Regulations and Operating Procedures** developed under the NEST4WB project directly address these challenges by establishing a comprehensive, harmonized, and institution-specific regulatory framework for laboratory operation across the consortium. The regulations translate national occupational health and safety legislation, environmental protection requirements, fire safety rules, and relevant institutional policies into practical, laboratory-level procedures that can be readily applied in daily teaching and training activities. By doing so, they bridge the gap between high-level legal obligations and the operational realities of laboratory-based education.

A key strength of the regulations lies in their clear definition of **roles and responsibilities** for all categories of laboratory users, including academic staff, laboratory engineers, technical personnel, students, lifelong learning participants, and visitors. This clarity supports accountability, ensures appropriate supervision, and reduces ambiguity in the management of laboratory activities. The

regulations also establish conditions for laboratory access, mandatory training and induction procedures, permitted and prohibited activities, and step-by-step guidance for responding to incidents and emergencies. These provisions are essential for managing risk in complex laboratory environments and for fostering a culture of safety and professionalism among all users.

Beyond their immediate safety function, the laboratory regulations serve a broader **strategic and enabling role** within the NEST4WB project. By providing a common regulatory foundation, they enable the systematic and sustainable integration of laboratory-based learning into modernized curricula and training offers across partner institutions. This includes Bachelor and Master programs, as well as lifelong learning courses targeting professionals and other non-traditional learners. The regulations ensure that hands-on learning activities can be delivered consistently, safely, and in compliance with legal and institutional requirements, thereby supporting educational quality, comparability of learning outcomes, and institutional credibility.

Furthermore, the harmonized yet adaptable nature of the regulations facilitates their transfer and reuse across different laboratories and institutions. This supports institutional capacity building, strengthens internal governance and quality assurance mechanisms, and contributes to the long-term sustainability and scalability of project results. In this way, the **Laboratory Regulations and Operating Procedures** function not merely as a set of safety rules, but as a foundational instrument for institutional transformation, enabling higher education institutions in the Western Balkans to deliver modern, practice-oriented, and future-proof education in the field of digitalized energy systems.

Description of the Report

This report presents the Laboratory Regulations and Operating Procedures developed within the framework of the NEST4WB project and constitutes a central reference document for the governance, management, and sustainable operation of laboratory infrastructures established or upgraded at partner higher education institutions. It consolidates institution-specific regulatory documents into a unified project deliverable, providing a coherent framework that supports both harmonization across the consortium and compliance with national legal and institutional requirements. Through this approach, the report contributes to strengthening institutional governance and ensuring that laboratory-based education is delivered in a safe, consistent, and high-quality manner.

The report has been developed in response to the recognition that modern laboratory infrastructures—particularly those supporting digitalized energy systems—require not only advanced equipment and teaching materials, but also robust regulatory frameworks to govern their use. The laboratories addressed in this report support a wide range of educational and training activities, including simulation of remote monitoring and control of switchgear, renewable energy systems, electronics and power engineering, artificial intelligence and machine learning, additive manufacturing and 3D printing, and virtual reality environments. These laboratories involve complex technical systems and, in many cases, elevated levels of electrical, mechanical, and operational risk. The report therefore provides the regulatory foundation necessary to ensure that such environments can be used effectively for teaching and training without compromising safety, legal compliance, or institutional accountability.

The primary function of the report is to establish clear, comprehensive, and enforceable rules governing all aspects of laboratory operation. It is intended for use by a broad range of stakeholders, including academic staff responsible for delivering laboratory-based courses, laboratory engineers and technical personnel responsible for maintaining equipment and ensuring safe operation, students and lifelong learning participants engaged in practical activities, institutional management responsible for oversight and compliance, and visitors who may access laboratory facilities under supervised conditions. By explicitly defining roles and responsibilities for each of these stakeholder groups, the report supports transparency, accountability, and effective coordination of laboratory activities.

From a structural perspective, the report follows a harmonized regulatory framework that is applied across all participating institutions. While each institution's regulations are tailored to its specific laboratory profile, infrastructure, and national legal context, they share a common structure and set of core principles. These include compliance with national occupational health and safety legislation, environmental protection laws, fire safety regulations, and relevant international and European standards (such as ISO, IEC, and EN). This harmonization facilitates comparability across institutions, supports quality assurance processes, and enhances the transferability and replicability of the regulatory framework within and beyond the consortium.

In terms of content, the report systematically addresses all critical dimensions of laboratory operation. It defines conditions for laboratory access and supervision, including eligibility requirements, training and induction procedures, and rules governing user conduct. It provides detailed provisions on protection against electrical and mechanical hazards, mandatory use of personal protective equipment (PPE), and preventive measures to minimize risks associated with laboratory work. Fire prevention and emergency response procedures are clearly articulated, including actions to be taken in the event of accidents, equipment failures, or hazardous situations, as well as reporting and documentation requirements.

Environmental protection and waste management constitute another vital component of the report. The regulations address the handling, storage, and disposal of hazardous and non-hazardous materials, promote environmentally responsible laboratory practices, and ensure compliance with applicable environmental legislation. These provisions support institutional commitments to sustainability and responsible resource management, which are increasingly important dimensions of higher education governance.

In addition to defining operational rules, the report establishes mechanisms for monitoring, reporting, and continuous improvement. It specifies procedures for recording incidents, non-compliance, and near-miss events, assigning responsibility for corrective actions, and documenting follow-up measures. Importantly, the report includes formal procedures for periodic review and updating of the regulations, ensuring that they remain aligned with technological developments, evolving educational practices, organizational changes, and updates to legal and regulatory frameworks. This dynamic approach supports the long-term relevance and effectiveness of the regulatory framework.

Beyond its immediate regulatory and operational role, the report serves a broader strategic and enabling function within the NEST4WB project. By providing a stable and transparent regulatory foundation, it enables the systematic integration of laboratory-based learning into modernized curricula and lifelong learning offers developed under the project. It ensures that hands-on learning

activities can be delivered safely, consistently, and at scale across Bachelor and Master programs, as well as professional training courses. Furthermore, the structured and transferable nature of the report supports replication of laboratory governance models within partner institutions and adoption by other higher education institutions in the region.

In this way, the report contributes not only to the safe operation of laboratories, but also to institutional capacity building, quality assurance, sustainability of project results, and the achievement of systemic impact. It underpins the long-term use and further development of laboratory infrastructures established under the NEST4WB project and supports the broader Erasmus+ CBHE objective of strengthening higher education systems in the Western Balkans through sustainable, practice-oriented, and high-quality educational provision.

To support transparency, comparability, and ease of reference, the report includes a **Summary of Key Regulatory Elements by Institution**, presented in tabular form below. The table provides a concise overview of the main laboratory types covered at each partner institution and highlights the core regulatory focus areas addressed in their respective Laboratory Regulations and Operating Procedures. While the regulations are tailored to national legal frameworks and institution-specific laboratory profiles, the table illustrates the degree of harmonization achieved across the consortium in terms of safety requirements, operational rules, environmental protection measures, and governance mechanisms. By synthesizing institution-specific information into a unified overview, the table facilitates cross-institutional comparison, supports internal quality assurance and monitoring, and demonstrates alignment with the project's capacity-building, sustainability, and replicability objectives under the Erasmus+ CBHE framework.

Summary of Key Regulatory Elements by Institution

Institution	Laboratory Type(s) Covered	Key Regulatory Focus Areas
AASKM – Academy of Applied Studies Kosovo and Metohija	Simulation of remote monitoring systems and control of switchgear	Electrical safety, lock-out/tag-out, fire prevention, PPE, emergency response, waste management, annual review procedures
FPRN – Faculty of Applied Sciences Podgorica (UDG)	AI/ML, 3D Printing and Virtual Reality Laboratory	Electrical and mechanical hazard prevention, fire safety, emergency procedures, environmental protection, structured revision process
University of Mostar (SUM)	Renewable Energy Sources Laboratory	Electrical and mechanical risks, rotating machinery, battery, and inverter safety, LLL access rules, environmental protection
University of East Sarajevo (UES)	Electrical Engineering Laboratories	Access control, supervision requirements, incident reporting, disciplinary measures, compliance monitoring
University of Mitrovica (UPKM)	Renewable Energy and Smart Energy Laboratories	OSH compliance, environmental protection, waste management, SOPs, document update procedures
University of Sinergija Bijeljina (USB)	Engineering and Energy Laboratories	General conduct rules, equipment use, staff and student responsibilities, fire, and emergency procedures
Universiteti Metropolitan Tirana (UMT)	Electronics & Renewable Energy Laboratory	Access control, supervision, professional conduct, energy equipment safety, laboratory documentation

The table demonstrates a deliberate and well-balanced combination of **convergence and contextual adaptation** across the partner institutions involved in the NEST4WB project. At the level of core principles, it reveals a strong degree of harmonization in regulatory domains that are critical for safe and effective laboratory operation, including occupational health and safety requirements, access

control and supervision arrangements, emergency response and incident reporting procedures, environmental protection measures, and mechanisms for monitoring compliance and reviewing regulations. This convergence reflects the shared project-level approach to laboratory governance and the common quality and safety standards promoted within the consortium, which are aligned with Erasmus+ CBHE objectives related to capacity building, quality assurance, and sustainability.

At the same time, the table illustrates how these shared principles have been **translated into institution-specific regulatory solutions** that consider national legislation, institutional policies, laboratory profiles, and technical infrastructures. Differences in laboratory focus—such as switchgear control and SCADA simulation, renewable energy installations, digital and AI-based laboratories, or electronics and energy systems laboratories—necessitate tailored safety measures, access rules, and operational procedures. Similarly, variations in national occupational health and safety regulations and environmental legislation require contextual adaptation to ensure full legal compliance. By allowing for such differentiation, the regulatory framework avoids a one-size-fits-all approach and instead supports meaningful institutional ownership and practical applicability.

This combination of harmonized structure and local adaptation enhances both the **effectiveness and transferability** of the laboratory regulations. Institutions benefit from a common reference model that facilitates mutual learning, comparison, and quality assurance, while retaining the flexibility needed to address their specific risks, organizational arrangements, and educational objectives. As a result, the regulatory framework supports coherent implementation across the consortium without compromising legal validity or operational relevance, thereby reinforcing the long-term sustainability, replicability, and systemic impact of the NEST4WB project within the Erasmus+ CBHE framework.

To ensure transparency, accessibility, and long-term availability of project outputs, the **Laboratory Regulations and Operating Procedures developed by each partner institution have been uploaded to the official NEST4WB project website**. The regulatory documents are published under a **dedicated project tab**: Manuals & Regulations (https://nest4wb.akademijakm.edu.rs/), allowing stakeholders, external institutions, and quality assurance bodies to access the full institutional frameworks. This online availability supports dissemination, replicability, and sustainability of project results in line with Erasmus+ CBHE requirements. For ease of reference, the table below lists each partner institution together with the corresponding web link to its laboratory regulatory framework.

Online Availability of Institutional Laboratory Regulatory Frameworks

Institution	Laboratory Regulations – Web Link
Academy of Applied Studies Kosovo and Metohija (AASKM)	[Link to institutional regulations]
Faculty of Applied Sciences Podgorica – UDG (FPRN)	[Link to institutional regulations]
University of Mostar (SUM)	[Link to institutional regulations]
University of East Sarajevo (UES)	[Link to institutional regulations]
University of Mitrovica (UPKM)	[Link to institutional regulations]
University of Sinergija Bijeljina (USB)	[Link to institutional regulations]
Universiteti Metropolitan Tirana (UMT)	[Link to institutional regulations]

To access this content log in to the project's web site, https://nest4wb.akademijakm.edu.rs/, using:

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The Laboratory Regulations and Operating Procedures developed within the NEST4WB project constitute the operational foundation for delivering structured, safe, and market-relevant training activities intended for economic stakeholders. Beyond their primary safety and governance function, these regulations enable higher education institutions to use advanced laboratory infrastructures as platforms for practice-oriented training, professional upskilling, and cooperation with industry and public-sector organizations operating in the energy domain.

The regulatory framework explicitly supports the organization and delivery of training activities for non-traditional learners, including professionals, engineers, technicians, and representatives of energy utilities, SMEs, and technology providers. By defining clear access conditions, supervision requirements, user responsibilities, and safety obligations, the regulations ensure that laboratory-based training for external participants can be conducted in a controlled and legally compliant manner. This is particularly relevant for laboratories involving smart grids, renewable energy systems, digital monitoring and control platforms, power electronics, and simulation environments, where improper use may pose safety, operational, or reputational risks.

Within WP3, the regulations function as a bridge between modernized laboratory infrastructure and economic application. They enable laboratories to be used for short professional courses, lifelong learning (LLL) programs, pilot trainings, and demonstration activities aligned with labor market needs. The standardized structure of the regulations facilitates cooperation with industry partners by providing transparency regarding safety rules, liability, supervision arrangements, and permissible activities. This transparency reduces barriers to external engagement and enhances institutional readiness for collaboration with economic actors.

Furthermore, the regulatory framework supports the alignment of training content with real-world operational practices by ensuring that laboratory activities mirror professional standards and workflows. This strengthens the relevance of training outcomes for employers and contributes to improved employability of graduates and trainees. By embedding economic-facing training within a robust governance framework, the regulations support the strategic WP3 objective of strengthening institutional capacity to deliver sustainable, practice-oriented education responding to the digitalization and transformation of the energy sector.

Contribution to Work Package Objectives

Governance and Training Enablement Framework under WP3

The figure illustrates the multi-layer governance framework established by Deliverable D3.4 and its role in enabling training procedures intended for economy. At the base layer, national legislation and international standards (OSH, environmental protection, fire safety, ISO/IEC/EN) define mandatory compliance requirements. These are translated at institutional level into internal policies and quality assurance systems.

At the operational level, Laboratory Regulations and Operating Procedures function as the central enabling instrument, governing access, supervision, safety, documentation, and continuous improvement. This regulatory layer directly supports the delivery of laboratory-based activities across Bachelor and Master programs, lifelong learning courses, and industry-oriented training.

At the top layer, regulated laboratories enable structured engagement with economic stakeholders, including energy companies, utilities, SMEs, and public-sector organizations. This results in practice-oriented training, upskilling and reskilling opportunities, improved employability, and sustainable post-project use of laboratory infrastructures. The figure demonstrates how WP3 connects infrastructure investment, governance, and economic impact within a coherent capacity-building model.

The laboratory regulations and operating procedures developed within the NEST4WB project represent a core enabling output that directly supports the achievement of multiple Work Package (WP) objectives, particularly those related to institutional capacity building, quality assurance, curriculum modernization, sustainability, and systemic impact. While laboratory equipment and teaching materials constitute visible project outputs, the regulatory framework documented in this deliverable provides

the organizational and governance conditions necessary for these outputs to be used effectively, safely, and sustainably. As such, the regulations function as a cross-cutting instrument that links infrastructure development, pedagogical innovation, and institutional reform.

From an institutional capacity-building perspective, the regulations significantly strengthen the ability of partner institutions to manage complex laboratory environments in a structured and professional manner. By formalizing safety rules, laboratory access conditions, supervision requirements, and operational responsibilities, the regulations reduce reliance on informal practices and individual discretion, replacing them with transparent and enforceable procedures. This contributes to improved institutional governance and supports WP objectives related to strengthening organizational structures, internal processes, and risk management capacities. In particular, the clear allocation of roles and responsibilities among academic staff, laboratory engineers, technical personnel, and institutional management enhances accountability and coordination, which are essential for the operation of advanced laboratories involving electrical systems, renewable energy installations, and digital technologies.

The regulations also contribute to quality assurance and standardization, which are central to the relevant WP objectives. By defining minimum safety requirements, mandatory training and induction procedures, rules for documentation and reporting, and procedures for monitoring compliance, the regulations establish a consistent baseline for laboratory operation across institutions. This supports comparability of learning environments and learning outcomes, facilitates internal and external quality assurance processes, and strengthens institutional credibility. In the context of Erasmus+ CBHE projects, where diversity of institutional capacity is common, such standardization is a critical mechanism for ensuring that curriculum modernization efforts lead to comparable and reliable educational outcomes across the consortium.

From a curriculum modernization and teaching perspective, the regulations play a decisive enabling role by allowing hands-on laboratory activities to be embedded safely and systematically into modernized Bachelor and Master programs, as well as lifelong learning (LLL) courses. Clear rules on supervision, user eligibility, safety training, and permitted activities ensure that students and professionals can engage with modern laboratory equipment under controlled conditions. This is particularly important for laboratories involving SCADA systems, remote monitoring and control of switchgear, renewable energy installations, power electronics, and digital platforms, where improper use could pose safety risks or compromise equipment integrity. By mitigating these risks, the regulations remove barriers to the increased use of laboratory-based teaching and directly support WP indicators related to improved learning outcomes, enhanced labor-market relevance, and development of interdisciplinary competences.

The inclusion of LLL participants within the regulatory framework further strengthens the contribution to WP objectives related to outreach, inclusiveness, and societal relevance. By explicitly defining access conditions and supervision requirements for professionals and non-traditional learners, the regulations enable higher education institutions to extend the use of laboratory infrastructures beyond traditional degree programs. This supports upskilling and reskilling of the existing workforce and reinforces the role of partner institutions as providers of continuous education in response to digitalization and energy transition challenges.

In terms of sustainability, the regulations make a substantial contribution to WP objectives aimed at ensuring the long-term use and impact of project results. The inclusion of procedures for monitoring compliance, reporting incidents and non-conformities, and periodically reviewing and updating the regulations ensures that laboratory governance remains dynamic and responsive to change. This is particularly important in the context of rapidly evolving technologies and regulatory environments. By embedding review mechanisms into institutional practice, the regulations support continuous improvement and reduce the risk that laboratory infrastructures become underutilized or obsolete after the project ends.

Furthermore, the shared structure and common regulatory principles adopted across partner institutions support replicability and scaling, which are essential for achieving systemic impact under the Erasmus+ CBHE framework. Although the regulations are adapted to national legal frameworks and institution-specific laboratory profiles, their harmonized format, terminology, and alignment with international standards (ISO, IEC, EN) make them transferable within the consortium and beyond. This supports WP objectives related to dissemination of results, adoption of good practices, and regional capacity building. Institutions outside the partnership can use the regulations as a reference model for establishing or upgrading their own laboratory governance frameworks, thereby amplifying the project's impact.

Overall, the laboratory regulations and operating procedures serve as a strategic connective element between technical infrastructure, educational innovation, and institutional reform. By addressing safety, governance, quality assurance, sustainability, and transferability in an integrated manner, the deliverable ensures that investments in laboratory modernization translate into durable educational and institutional benefits. In doing so, it makes a substantive and measurable contribution to the Work Package objectives and underpins the long-term impact of the NEST4WB project at institutional, national, and regional levels within the Erasmus+ CBHE framework.

Monitoring and Evaluation Framework (Key Performance Indicators)

To ensure transparent monitoring, evidence-based evaluation, and long-term sustainability of the activities implemented under Work Package 3, a set of Key Performance Indicators (KPIs) has been defined. These indicators translate the regulatory, organizational, and training-related objectives of Deliverable D3.4 into measurable parameters that allow partner institutions and project management to systematically track implementation progress, operational effectiveness, and impact.

The KPIs focus on institutional capacity building, integration of regulated laboratories into teaching and training activities, engagement with economic stakeholders, safety and compliance performance, and sustainability beyond the project lifetime. They are designed to be realistic, auditable, and applicable across different institutional contexts, while remaining aligned with Erasmus+ CBHE reporting requirements and quality assurance principles. The table below summarizes the core KPIs used to monitor WP3 implementation and to support continuous improvement of laboratory-based training procedures intended for economy.

KPI Category	Indicator	Measurement Unit	Target / Monitoring Logic	WP3 Relevance
Capacity Building	Number of laboratories operating under approved regulations	Number	All upgraded/new labs formally regulated	Institutional readiness

KPI Category	Indicator	Measurement Unit	Target / Monitoring Logic	WP3 Relevance
Training Delivery	Number of laboratory-based training activities delivered annually	Number / year	Increasing trend post-project	Training sustainability
Economic Engagement	Number of LLL / industry-oriented training sessions	Number / year	Minimum 1–2 per institution	Economy-facing impact
Human Resources	Number of trained laboratory users (students + professionals)	Persons / year	Continuous increase	Skills development
Safety & Compliance	Percentage of users completing safety induction	%	100% mandatory	Risk management
Quality Assurance	Number of incident / near-miss reports documented and reviewed	Number / year	Reported and addressed	Continuous improvement
Curriculum Integration	Number of study programs using regulated laboratories	Number	Embedded in BSc/MSc	Curriculum modernization
Sustainability	Frequency of regulatory review and update	Months / years	At least every 24 months	Long-term relevance

Conclusions and Recommendations

The **Laboratory Regulations and Operating Procedures** developed within the NEST4WB project represent a **foundational, strategic, and enduring output** that underpins the effective, safe, and sustainable use of the laboratory infrastructures established or upgraded through the project. While the acquisition of modern equipment and the development of laboratory-based teaching materials constitute visible project achievements, the regulatory framework documented in this deliverable provides the essential organizational and governance conditions that allow these investments to generate long-term educational and institutional value. By systematically addressing occupational health and safety, environmental protection, emergency preparedness, user responsibilities, and compliance monitoring, the regulations safeguard both human resources and physical assets and ensure that laboratory activities are conducted in a controlled and professional manner.

From a **long-term sustainability perspective**, the regulations play a decisive role in embedding laboratory-based education into the core activities of partner institutions. Their integration into regular Bachelor and Master programs, as well as into lifelong learning (LLL) courses, ensures continuity of use beyond the project lifetime and enables successive cohorts of students and professionals to benefit from modern laboratory environments. By clearly defining roles, responsibilities, and procedures, the regulations strengthen institutional ownership of laboratory infrastructures and reduce reliance on individual expertise or informal arrangements. This is particularly important in higher education systems characterized by staff turnover and evolving organizational structures, as it supports continuity and resilience at institutional level.

The regulations are also designed to support **adaptive and dynamic sustainability**. Recognizing that digitalized energy systems and related technologies evolve rapidly, the regulatory framework incorporates mechanisms for incident reporting, monitoring compliance, and periodic review and updating. These mechanisms enable institutions to respond proactively to technological innovation, changes in laboratory infrastructure, emerging safety risks, and updates to national legislation or international standards. In this way, the regulations support continuous improvement and ensure that laboratory governance remains relevant, effective, and aligned with best practices over time.

From a **capacity-building and institutional development perspective**, the regulations contribute to strengthening governance structures, internal quality assurance processes, and risk management capacities within partner institutions. By formalizing laboratory operation and supervision, the regulations support more consistent implementation of laboratory-based teaching across programs and departments, enhancing comparability of learning experiences and outcomes. This strengthens institutional credibility and supports engagement with external stakeholders, including accreditation bodies, industry partners, and professional learners. Furthermore, the harmonized structure of the regulations across institutions facilitates benchmarking, mutual learning, and cooperation within the consortium, reinforcing the project's regional dimension and contributing to systemic improvement in higher education governance.

The regulatory framework also has a significant **strategic impact beyond immediate safety considerations**. By enabling safe and structured access to advanced laboratory environments, it removes barriers to curriculum modernization and pedagogical innovation. Academic staff can confidently integrate hands-on laboratory activities into modernized curricula, knowing that robust safety and operational procedures are in place. This directly supports the development of practice-oriented and interdisciplinary education aligned with labor market needs in the field of digitalized energy systems, thereby contributing to improved employability of graduates and enhanced relevance of higher education provision.

Importantly, the regulatory framework positions laboratory infrastructures as long-term training assets for economic engagement. By enabling safe and structured access for professional learners and external stakeholders, the regulations transform laboratories from purely academic facilities into platforms for skills development, upskilling, and cooperation with the energy sector. This ensures that the training procedures developed under WP3 remain relevant, scalable, and economically impactful beyond the project lifetime.

To **maximize the long-term impact, sustainability, and transferability** of this deliverable, the following recommendations are proposed:

- **Formal institutional embedding**: Partner institutions should ensure that the Laboratory Regulations and Operating Procedures are formally adopted as binding internal documents through institutional governance mechanisms. This may include approval by faculty councils, senates, or management bodies, and integration into institutional rulebooks or quality manuals.
- **Continuous capacity development and training**: Institutions should establish structured and recurring training programs for all laboratory users, including induction for inexperienced users and refresher training for existing staff and students. Training activities should be documented and linked to access permissions, reinforcing accountability and safety culture.
- **Systematic review and evidence-based updating**: The regulations should be reviewed at regular intervals and following significant incidents or infrastructural changes. User feedback, incident reports, and technological assessments should inform updates, ensuring that the regulations remain responsive and effective.
- **Strategic reuse and expansion**: The documented regulations should be actively used as reference models when developing new laboratories, upgrading existing facilities, or establishing specialized training centers, both within partner institutions and in cooperation with external organizations. The promotes harmonization, efficiency, and scaling of good practices.

- **Integration with quality assurance and accreditation**: Where feasible, institutions should align laboratory regulations with internal quality assurance systems and external accreditation and evaluation processes. This further embeds the regulations into institutional practice and enhances their strategic value.

In conclusion, the Laboratory Regulations and Operating Procedures developed within the NEST4WB project function not merely as operational guidelines, but as **strategic governance instruments** that enable sustainable use of laboratory infrastructures, support curriculum modernization, and strengthen institutional and regional capacity building. Their continued application, review, and adaptation will contribute to enhanced educational quality, improved employability, and long-term systemic impact in higher education in the Western Balkans, fully aligned with the objectives and expected outcomes of the Erasmus+ Capacity Building in Higher Education action.

REPORT DONE BY:

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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 D3.4

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:_____

prof. Ing. Miroslav Vozňák, Ph.D.

Digitálně podepsal prof. Ing. Miroslav Vozňák, Ph.D.
Datum: 2026.01.23 08:48:30 +01'00'

REPORT DONE BY:

_____

[Name and Surname]

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[Name and Surname]