Deliverable 6.15

Outlines of Training materials on Simplified Success Monitoring (Task 6.7)

Sofia, 28 July 2023

Contacts:

Borislav Ivanov
Centre for Energy Efficiency EnEffect
bivanov@eneffect.bg

Jan Steiger
Passive House Institute
jan.steiger@passiv.de

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957175. The presented contents are the author's sole responsibility and do not necessarily reflect the views of the European Union. Neither the CINEA nor the European Commission are responsible for any use that may be made of the information contained therein.

Table of Contents

EXECUTIVE SUMMARY

The OutPHit project aims to streamline the performance evaluation of buildings and create a systematic approach to monitoring equipment, data handling, data evaluation, and performance certification. This deliverable builds upon the knowledge and experience gathered from previous projects and the pilot projects of OutPHit, with the objective of developing an enhanced set of training materials on success monitoring. On-site performance verification in buildings forms an integral part of a comprehensive quality assurance scheme throughout the value chain, encompassing certified professionals, products, materials, and techniques. These training materials are crucial in establishing monitoring and performance evaluation as standard practices. The materials outlined here include a systematic approach to monitoring equipment, data handling, data evaluation, and performance certification, all of which are being developed within the OutPHit project.

The development of these materials has run concurrently with the formulation of the approaches, allowing the OutPHit consortium to disseminate and exchange the necessary knowledge. Feedback was gathered to refine the draft materials until they reach a mature stage by the project's completion. This process ensured that the materials are practically tested before the project concludes, making them available for additional training activities and dissemination immediately or even before the project's conclusion.

The training materials consist of 12 PowerPoint presentations, each delving into essential aspects of the process. These presentations serve as the backbone and content material for workshops and training sessions conducted by trainers across the consortium. To this end translation into the partner’s languages have been prepared.

The topics covered in the presentations are designed to equip trainers with the necessary knowledge and understanding to effectively implement the developed approaches within the OutPHit project. The presentations include:

- **Outline**: An introduction to the structure and content of the training materials.
- **Sensor Specs**: Exploring the specifications and requirements of monitoring sensors.
- **Sensor Suite**: Understanding the holistic approach of sensor selection and placement.
- **Placing Sensors**: Detailed guidelines on strategically placing sensors for optimal data collection.
- **Data Handling and Performance Monitoring**: Methods to handle and analyse data for performance evaluation.
- **Living Quality Indicators**: Identifying and assessing indicators of living quality in buildings.
- **Uncertainties 1**: Understanding and managing uncertainties in data and measurements.
- **Uncertainties 2**: Further exploration of uncertainties and their impact on performance evaluation.
- **Air Quality**: Evaluating indoor air quality for healthier living spaces.
- **Airborne Fungal Spores Assessment**: Understanding the importance of fungal spore assessment in building performance.
- **Living Quality Assessment**: Techniques to assess the overall living quality of buildings.

- **Verified Performance**: Certifying and verifying the performance achievements of buildings.

The training materials were continuously updated throughout the project as new approaches and insights emerged. Lessons learned from practical applications were incorporated to ensure the highest level of efficacy and relevance. With this iterative process, the training materials have been thoroughly tested even before the project's conclusion, enabling immediate dissemination and use for further training activities.

A significant advantage lies in the active involvement of partners experienced in training and related projects. Leveraging their international networks, the project's results will be shared widely, encouraging other course providers to disseminate the knowledge. Moreover, translating the materials into multiple languages will ensure accessibility and reach to a broader audience across Europe.

This deliverable plays a crucial role in achieving the outPHit project's objectives by empowering trainers and professionals with comprehensive knowledge and resources. By driving the adoption of advanced monitoring and evaluation practices, it will contribute to the creation of more energy-efficient, sustainable, and comfortable buildings not only in Europe but also beyond. To ensure widespread dissemination of the project results, existing course providers will be engaged, and the partners will translate the materials from English into their respective national languages, optimizing the accessibility and impact of the training resources.

1. INTRODUCTION

Efforts to improve building renovation practices have been supported by initiatives such as the Energy Performance of Buildings Directive, which emphasizes the need to decrease the financial burden on building owners while maintaining high-quality renovation outcomes. Monitoring after renovation is of paramount importance in ensuring that building performance meets the desired energy efficiency standards. Post-renovation monitoring allows stakeholders to assess the effectiveness of the implemented measures, identify potential issues, and optimize building performance over time. It is essential for verifying the success of the renovation project and making data-driven decisions to improve future retrofitting efforts. Moreover, measured performance data is also internationally comparable, unlike calculated data from differing calculation methodologies for code compliance in the member states.

Several training initiatives have been undertaken to enhance the skills and knowledge of professionals involved in building renovation and prefabricated renovation. These initiatives focus on equipping participants with the necessary expertise to understand the principles and techniques of step-by-step and prefabrication renovations, as well as the significance of pre- and post-renovation monitoring.

Projects such as EuroPHit, Fit-to-nZEB, and Construction Blueprint have played pivotal roles in developing specialized training materials for professionals in the construction sector. These courses cover a range of topics, including the integration of prefabrication techniques, step-by-step retrofitting, and the importance of continuous monitoring for successful renovation outcomes.

However, despite the availability of training initiatives, they may not be sufficient to provide an in-depth understanding of the concept and the various design and construction approaches. This indicates the need for longer upskilling programs that cater to individuals with different qualification levels.

To address this, the outPHit project offers opportunities for additional upskilling courses that can be incorporated into regular training plans of educational establishments and offered by accredited vocational training centres. This course aims to enhance the qualification levels of professionals in architecture, civil engineering, energy engineering, heating, ventilation, and air conditioning with regard to building performance monitoring.

2. TARGET GROUPS FOR THE OUTPHIT MONITORING TRAINING

Regrettably, there is currently no uniform classification of professions and professional occupations across EU countries, underscoring the need for an adaptable approach in the proposed training scheme within outPHit. This flexibility ensures that the training modules on monitoring can be effectively applied to diverse national systems, serving as an essential component of continuous professional development or seamlessly integrating into existing qualification standards. However, we can leverage the EU ESCO (European Skills, Competences, Qualifications and Occupations) classification system, which offers a standardized framework for identifying relevant professional roles and skills applicable to monitoring practices in the building sector. With outPHit's training content, we aim to empower building professionals with the knowledge and expertise needed to implement advanced monitoring and evaluation practices, promoting energy-efficient, sustainable, and comfortable buildings across Europe and beyond. Together, we will pave the way for a more successful and impactful future in the realm of building performance evaluation and monitoring. The occupations relevant to the OutPHit content include:

1 - Managers

- Construction manager

Examples of the occupations classified here:

- ✓ Civil engineering project manager
- ✓ Construction project manager
- ✓ Project builder

2 - Professionals

- Civil Engineer

Examples of the occupations classified here:

- ✓ Civil engineer

- Mechanical engineers

- Energy engineers

Examples of occupations classified here:

- ✓ Energy systems engineer
- ✓ Renewable energy engineer
- ✓ Solar energy engineer
- ✓ Thermal engineer

- Electrical engineer

- Building architect

3 - Technicians and associate professionals

- Civil engineering technicians

- Electrical engineering technicians
  - ✓ electrical engineering technician

- Mechanical engineering technicians
  - ✓ heating, ventilation, air conditioning and refrigeration engineering technician
  - ✓ refrigeration air condition and heat pump technician

- Construction supervisors

3. SUCCESS MONITORING TRAINING FRAMEWORK

The Training Framework for the "Simplified Success Monitoring" program is designed to impart essential competencies, skills, and knowledge to trainers and professionals involved in building performance evaluation. The framework employs a structured and systematic approach to ensure effective delivery of the 12 presentations that form the backbone of the training materials.

Methodology:

1. Needs Assessment: Conduct an initial needs assessment to understand the knowledge and skill gaps of the target audience. This will help tailor the training content to meet specific requirements.

2. Learning Objectives: Define clear and measurable learning objectives for each presentation. These objectives will guide the development of content and enable learners to understand the expected outcomes.

3. Modular Approach: Organize the training into 12 distinct modules, each corresponding to the respective presentation. This modular approach allows participants to focus on specific topics and facilitates easy customization and updating of the materials.

4. Active Learning: Incorporate interactive elements such as hands-on exercises, group discussions, case studies, and practical demonstrations to engage learners actively.

5. Assessment: Implement regular assessments to gauge participants' progress and understanding. Feedback from assessments will inform improvements in content delivery.

6. Continuous Improvement: Emphasize continuous improvement by gathering feedback from trainers and participants, updating materials based on lessons learned, and keeping pace with industry advancements.

Presentation №	Competence	Skills	Knowledge
Outline	Understand the training structure and content	Navigation through the training materials. Identifying key sections and topics in the materials. Summarizing the main concepts and objectives.	Overview of the entire training program. Purpose and importance of each presentation. Structure and flow of the training modules

Sensor Specs	Assess the specifications of monitoring sensors	Analysing technical specifications of sensors. Comparing sensor features and functionalities. Identifying sensors suitable for specific applications. Interpreting sensor datasheets and manuals.	Types of sensors commonly used in building monitoring. Factors influencing sensor selection for different purposes. Sensor calibration procedures and standards.
Sensor Suite	Implement a holistic approach to sensor selection and placement	Integrating sensors into building design. Evaluating the impact of sensor placement on data quality. Coordinating with different teams to deploy sensors. Conducting cost-benefit analyses for sensor deployment.	Understanding building-specific sensor requirements. Advantages of using a sensor suite for comprehensive monitoring. Principles of sensor network design and optimization.
Placing Sensors	Strategically place sensors for effective data collection	Installing sensors in optimal locations. Calibrating sensors for accurate readings. Ensuring sensor compatibility with data handling systems. Applying data quality control measures	Criteria for identifying suitable sensor locations. Techniques for ensuring spatial and temporal representativeness of data. Methods for minimizing signal interference and noise
Data Handling & Performance Monitoring	Handle and evaluate data for performance assessment	Analysing data using statistical methods. Identifying trends and patterns in building	Data evaluation techniques for performance monitoring. Methods to handle and

		performance data. Assessing the reliability and accuracy of data.	process large datasets. Data visualization techniques for performance evaluation.
Living Quality Indicators	Identify indicators of living quality in buildings	Recognizing key indicators of occupant comfort. Evaluating factors affecting indoor living quality. Assessing the impact of indoor conditions on occupants.	Relationship between indoor environment and occupant well-being. Importance of monitoring living quality indicators.
Uncertainties 1	Address and manage uncertainties in data and measurements	Quantifying uncertainties in measurement. Applying error propagation techniques. Developing contingency plans for uncertain scenarios.	Sources of uncertainties in building performance data. Methods to minimize uncertainties during data collection. Methods to improve data accuracy and reliability.
Uncertainties 2	Explore uncertainties' impact on performance evaluation	Evaluating the influence of uncertainties on results. Identifying factors contributing to uncertainties. Addressing uncertainties in performance certification.	Sensitivity analysis for performance assessment. Understanding confidence intervals and statistical significance. Uncertainty quantification techniques in certification.
Air Quality	Evaluate and ensure indoor air	Conducting indoor air quality assessments.	Factors influencing indoor air quality.

	quality	Identifying common indoor air pollutants. Implementing ventilation strategies for better air quality. Measuring and monitoring indoor air pollutants.	Health effects of indoor air pollution.
Airborne Fungal Spores Assessment	Understand the significance of fungal spore assessment	Sampling methods for airborne fungal spores. Analysing fungal spore data. Applying standards for fungal spore assessment.	Role of airborne fungal spores in indoor environments. Health implications of airborne fungal spores.
Living Quality Assessment	Apply techniques to assess the overall living quality of buildings	Conducting living quality assessments. Analysing assessment results to derive conclusions. Interpreting assessment data for decision-making.	Integration of living quality assessment in building performance. Evaluating the effectiveness of living quality indicators. Linking living quality indicators to building performance.
Verified Performance	Certify and verify building performance achievements	Implementing performance certification processes. Analysing performance certification documentation. Interpreting performance reports for stakeholders.	Methods for verifying building performance. Importance of third-party verification. Criteria for achieving performance certification.

The training framework combines theoretical knowledge with practical application to equip learners with the necessary competence, skills, and knowledge for successful building performance evaluation and monitoring. As participants progress through the modules, they

will gain a comprehensive understanding of the subject matter and be well-prepared to disseminate this valuable knowledge in further training activities and beyond.

4. CURRICULA FOR DIFFERENT TARGET GROUPS

Using the chosen methodological approach, it becomes feasible to develop training programs tailored to various target groups based on their professional roles and qualification levels. This flexibility applies at both a broader level using the ESCO classification and at a more detailed national level, considering the topic-specific competences already acquired within the respective national qualification system. To illustrate, an example is provided below, focusing on enhancing the skills of building technicians operating at EQF level 3-4. As these professionals will most likely be responsible for installing the monitoring equipment on site.

4.1. TARGET GROUPS

Technicians and associate professionals at EQF 3-4, considering the following occupational profiles:

- Civil engineering technicians
- Electrical engineering technicians
  - ✓ electrical engineering technician
- Mechanical engineering technicians
  - ✓ heating, ventilation, air conditioning and refrigeration engineering technician
  - ✓ refrigeration air condition and heat pump technician
- Construction supervisors

4.2. COURSE PARTICIPANT PROFILE

The participant is a skilled professional with the ability to work independently and possesses the necessary expertise to oversee construction activities based on the provided design documentation. They demonstrate proficiency in interpreting technical documents and construction details. Their responsibilities include designing workflows for building systems. The participant applies their acquired knowledge and practical skills effectively in problem-solving scenarios, and they can work both independently and collaboratively within a team. They are proficient in working with traditional building materials and systems, as well as prefabricated building components. Additionally, the participant is eager to pursue further education, and their interest remains consistently focused on the advancement of building concepts, materials, and technologies.

4.3. REQUIREMENT FOR TRAINERS

Individuals who have successfully completed higher education in the relevant field are eligible to become instructors for specific subjects or modules in professional training. However, if a subject or module lacks a corresponding professional direction in the Classifier of Higher Education and Professional Fields, as per Resolution No. 125 of 2002 by the Council of Ministers (Government Gazette No. 64 of 2002), individuals without higher education and without the "teacher" professional qualification can still teach if they hold a third degree of professional qualification in the specialty of "Construction Technician,"

following the guidelines and regulations outlined in the Law on Vocational Education and Training.

To maintain their proficiency, it is advised that trainers participate in a course every three years to keep themselves updated on the latest developments and advancements in their respective professional knowledge, skills, and competencies.

4.4. NECESSARY EQUIPMENT AND FACILITIES

In the study room, each student should be provided with a desk and chair, and the trainer should have their own workstation with a desk and chair as well. The classroom should be equipped with essential teaching tools, such as a study board, cabinets, screens, and blackboards. Additionally, there should be a writing board and various teaching aids, including demonstration mock-ups, models, real samples, visualizing boards, and educational videos. To facilitate interactive learning, multimedia equipment like computers, projectors, and relevant visualization software products should also be available.