Learning Scenarios on healthy building

Co4 Health

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Project Coordination

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Project Partners:

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Vocational Training Centre JEDU Nivala

Construction School Andrea Palladio (SCVAP) Vicenza

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Construction School Complex No.1 (ZSB1) Poznań

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Introduction

The developed learning scenarios with practical tips were used as the basis for developing the learning units.

They correspond directly to the specific content of each learning unit.

The focus was on action-oriented teaching methods.

Introduction to healthy building

LS 01:	**HEALTHY BUILDING** **Introduction to healthy building**
Description of the Learning Scenario (LS):	**Time limit: 90 minutes**

Description of the situation: The apprentices are undergoing vocational training in the construction industry in the areas of building construction, civil engineering or finishing. They already have a basic knowledge of building materials and construction materials in building construction, civil engineering or finishing. This learning unit is intended to provide an introduction to the topic of healthy building and living.

Work task:

The task for learning unit is to deal with the basics of building biology, to learn what building biology is and what influence building biology has on building quality and the health of users. Learners are familiarised with selected examples.

General Implementation guidelines and clarifications

- used in basic training for the building trades in the building, civil engineering and finishing trades at level 4 and in the foreman and master craftsman training at level 6
- it starts with a short introduction and definition of what building biology is, the aims of building biology and the areas of work in the construction industry in which it intervenes
- development of building biology in the past and today
- influence on indoor air – risk factors in indoor spaces (categorisation into 3 groups)
- Learners make an overview of the risk factors, their causes and the associated pollutants contained in the building materials
- They learn which health problems can occur due to certain risk factors
- They discuss the 18 goals of the Building Biology Agenda 2025 and how these can be implemented in working and everyday life
- Learners are actively involved in a topic-related discussion throughout the learning unit introduction

Teaching materials

- Interactive white board
- - Digital devices (tablets, laptop, PC)
- - Power Point presentations
- - videos
- - Case studies/examples
- - Handouts and worksheets

Professional competences	**Language and communication competences**
The learners ...	

• are aware of the health effects of different building materials and construction methods • have knowledge of standards, guidelines, reference values and know the criteria for healthy building • know the health effects of risk factors • have knowledge of the 5 main groups of building biology guidelines (indoor climate/building materials and interior design/room design and architecture/environment, energy and water/eco-social living space)		• familiarise themselves with the specialist terminology of building biology • are able to read, interpret and accurately explain material data sheets in order to develop a proper understanding of the risk factors for the health of future building users • ... communicate with stakeholders within the group, • ... write the information on the building features • ... correctly apply specialised terminology and software,
Previous knowledge	**Assessment**	**interdisciplinary notes**
▪ Fundamentals of building construction ▪ Basic knowledge of building physics ▪ Basic knowledge of common building materials and their effects ▪ Specialist knowledge of environmental protection and the impact of building materials ▪ Basic knowledge of the effects of the carbon footprint ▪ Have literacy skills,	▪ Team work ▪ Knowledge test	
Evaluation - short knowledge test (10 questions) digitally via Forms - subsequent digital evaluation via Forms		

Topic overview

1. Introduction to building biology (10 minutes)

Objective: The learners are familiarised with the topic of building biology and healthy building.

The following content is taught:

- enquire what they understand by this and what expectations they have of this learning unit
- define what building biology is
- explain its objectives
- name fields of work and/or areas of work of building biologists

2. Influence of building biology on building quality and the health of users (25 minutes)

Objective: The participants know the risk factors of indoor spaces and the categorisation into the 3 main risk groups.

The following content is taught:

- the 3 main risk groups with the associated risk factors/ building material or construction material/ contained pollutant
- Examples of health problems caused by selected risk factors (presented in a table and, if possible, with short videos)

Exercise: The learners are to present the risk factors of a specific room in a table

3. The Building Biology Agenda 2025 (10 minutes)

   Objective: The participants know the 18 goals of the Building Biology Agenda and are informed about the applicable guidelines and legal regulations in the respective country.

   The following content is conveyed:

   - the existing regulations, guidelines, laws and ordinances in the country
   - 18 goals of the Building Biology Agenda 2025

4. The 25 guidelines of building biology (25 minutes)

Objective: Participants have knowledge of the guidelines of building biology.

The following contents are taught:

- the 25 guidelines of building biology
- the categorisation into the 5 main areas such as indoor climate/ building materials and interior design/ interior design and architecture/ environment, energy and water/ eco-social living space

5. Building biology guideline values/limit values (10 minutes)

Objective: The participants are informed about selected limit values, e.g. for bedrooms.

The following content is conveyed:

- Selected guideline and limit values for risk factors

Exercise: Present selected risk factors and their measurable values in a table.

6. Evaluation (10 minutes)

Objective: Knowledge test of the participants in 10 digital questions and evaluation (digital)

Moisture Sources

Moisture sources		
Description		Reference value in time: 2 x 45 minutes
Description of the situation: The students are first or second year building construction students (level 4). They don't have much knowledge about the sources of moisture in a building **Working task:** The aim is that after the lessons, students will know what the different sources of moisture are in a building. They will understand how a building can be protected from moisture sources and how their own actions can influence the creation of moisture.		
General implementation guidelines and clarifications		
· Express learning objectives, emphasizing the impact of moisture sources in construction · Using images to show different sources of moisture · provide case studies or examples from real-world building projects that show the consequences of moisture sources · as an exercise in how to minimize or avoid the effects of moisture sources on a building · discussion on the topic and asking questions about the topic		
Teaching materials		
· Powerpoint presentation: covers the main sources of moisture in construction · Visual aids: pictures and videos of how to minimize damages from moisture sources · Case studies and examples · Group work		
Professional competence	**Personal and social competence**	**Language and communication competences**
Students should:		
· know different sources of moisture · how to minimize the effects of moisture sources · Identify materials used to prevent moisture sources	· Collaboration and Communication	· communicate with other students and the teacher · improve their active listening skills
Prior knowledge · basic knowledge in the use of digital devices · previous knowledge of basic construction	**Assessment** · team work · Knowledge test	**Interdisciplinary references** ·
Application in the following professions: House builder	**Levels:** · **4**	

Topic overview

Part 1: Moisture sources (45 minutes)

Objective: Introduce students to the topic

1. Moisture sources and how to avoid them(35 minutes)

   Review the main sources of moisture in construction and how they can be avoided

2. Examples and videos of moisture sources (10 minutes)

Part 2: Teamwork how to protect against moisture sources (40minutes)

Objective: Construction methods to avoid moisture sources

1. Work in groups or in pairs (20minutes)

   Finding solutions and materials to avoid damage caused by moisture sources

2. Group work presentations(20minutes)
3. Knowledge test (5 minutes)

Moisture sources

Description Reference value in time: 2 x 45 minutes

Description of the situation: The students are first or second year building construction students (level 4). They have limited knowledge about moisture behavior in building materials. The goal is to develop awareness of how responsible work practices help avoid moisture damage.
Working task: After the lessons, students will be able to:
• Recognize what moisture-damaged materials look like
• Identify causes of moisture damage in construction projects
• Understand how responsible working methods prevent moisture problems
• Suggest solutions and preventive actions

General implementation guidelines and clarifications

- Express learning objectives, emphasizing the impact of responsible work on moisture prevention
- Use images to show examples of moisture damage and prevention methods
- Provide case studies and real-world project examples
- Facilitate group discussions and encourage active participation
- Encourage students to ask questions and reflect on their own practices

Teaching materials

- PowerPoint presentation: covers main building materials and risks of moisture damage
- Visual aids: photos, drawings, and videos
- Case studies and examples from real construction projects
- Group work tasks and worksheets

Professional competence	**Personal and social competence**	**Language and communication competences**
Students should:		
· Understanding risks of using moisture-damaged materials · Ability to identify damage and causes · Awareness of preventive work methods	· Collaboration in group tasks · Responsibility in site practices	· Discuss and explain causes and solutions with peers · Improve active listening and communication skills
Prior knowledge · Basic knowledge of construction practices · Basic use of digital devices	**Assessment** · Teamwork evaluation · Knowledge test on moisture damage and preventive practices	**Interdisciplinary references** · Application in the following professions: · House builder · Construction worker

Application in the following professions:	**Levels:**
House builder	· **4**

Topic overview

Part 1: Introduction to Moisture Damages in Construction Materials (45 minutes)

3. Objective: Introduce students to the importance of responsible working methods to prevent moisture damage in construction projects
   - Causes and risks of moisture damage (30 minutes)
     – Common sources of moisture on construction sites
     – Improper storage of materials and poor site practices
     – Short- and long-term effects of moisture damage
   - Examples and visual materials (15 minutes)
     – Pictures of moisture-damaged building materials
     – Videos and real project cases

Part 2: Teamwork and Application (45 minutes)

Objective: : Identify causes, consequences, and preventive practices related to moisture damage. Work in groups or in pairs (40minutes)

- Group work and discussion (40 minutes)

– Students work in pairs or small groups to analyze given case studies

– Identify what caused the damage, what consequences followed, and how it could have been prevented

– Suggest possible repair alternatives

- Knowledge test (5 minutes)

– Short quiz to check understanding

Moisture sources

Description Reference value in time: 2 x 45 minutes

Description of the situation: The students are first or second year building construction students (level 4). They don't have much knowledge about moisture-damaged materials

Working task: The aim is that after the lessons, students will know what moisture-damaged materials looks like in a building. Students have knowledge of what could cause moisture damage to building materials

General implementation guidelines and clarifications

- Express learning objectives, emphasizing the impact of moisture-damaged building material
- Using images to show different moisture-damaged building materials and why is it moisture damaged
- provide case studies or examples from real-world building projects that show the consequences if structure or building material is moisture-damaged
- as an exerc
- discussion on the topic and asking questions about the topic

Teaching materials

- Powerpoint presentation: covers the main building materials and their possible moisture damage
- Visual aids: pictures and construction drawing
- Case studies and examples
- Group work

Professional competence	**Personal and social competence**	**Language and communication competences**
Students should:		
· know what are the consequences of using moisture-damaged building materials · identify moisture-damaged building material or structure · Identify the cause on moisture-damaged material · know moisture behavior of building materials	· Collaboration and Communication	· communicate with other students and the teacher · improve their active listening skills
Prior knowledge · basic knowledge in the use of digital devices · previous knowledge of basic construction	**Assessment** · team work · Knowledge test	**Interdisciplinary references** ·

Application in the following professions:	**Levels:**
House builder	· **4**

Topic overview

Part 1: Moisture damages in different materials (45 minutes)

Objective: Introduce students to the topic

4. Moisture damages and how to avoid them(35 minutes)

   Review the moisture damages in different materials and what is the cause and what is it caused by?

5. Examples and videos of moisture damages (10 minutes)

Part 2: Teamwork of moisture damages in different materials (40minutes)

Objective: identify the causes, consequences and possible repairs of damage to building materials

4. Work in groups or in pairs (40minutes)

   Giving examples of moisture damages structure and group discus of the example. What is caused damages, damages causes what? And possible repair alternative

5. Knowledge test (5 minutes)

Moisture comfort

Description Reference value in time: 4 x 45 minutes

Description of the situation: The students are enrolled in a Level 4 EQF course on building construction. They have a basic understanding of moisture concepts, and they need to delve deeper into the understanding of moisture concepts such microclimate, climate and comfort, health and wellbeing, thermal comfort, human factors and thermal sensation, definition of humidity, indoor humidity monitoring, health effects with high/low humidity, mold and fungal growth, humidity and diseases.

Working task: The task for the lessons is to study the principles of humidity and moisture to learn differences between them and identify the reasons why it's formed. They will analyze how moisture and humidity affect comfort and health as well; they will understand methods to minimize their impact using different construction techniques and materials. The task concludes with case studies to reinforce their learning and apply their knowledge to real-world scenarios.

General implementation guidelines and clarifications

- clearly state the learning objectives, emphasizing the importance of understanding humidity and moisture and their impact on comfort and health.
- use thermographic and hygrometer to visually demonstrate where moisture or humidity commonly occurs, understand the actual cause and correctly diagnose the reasons that lead to the appearance of rising damp or any other type of damp in a home.
- include a brief review of the causes of the humidity rising in construction materials, highlighting those prone to creating moisture problems.
- provide case studies or examples from real-world building projects that show the consequences of poor moisture management.
- discuss various theoretical mitigation techniques, enhanced insulation strategies, and improved construction details.
- encourage students to engage in discussions about the challenges of identifying and mitigating moisture problems in different building designs.
- conclude with a summary of key concepts, followed by a task where students write a brief explanation of how they would apply these principles in a hypothetical construction scenario.
- allocate time for reflection and discussion to allow students to process information, ask questions, and share insights.

Teaching materials

1. PowerPoint presentation:
   - slides covering key concepts of moisture and humidity and their effects on comfort and health leading to diseases; overview on mitigation strategies.
2. Visual aids:
   - diagrams showing locations in building structures with effects arising from humidity and moisture.
   - cross-sectional illustrations of building elements highlighting moisture and humidity effects.
3. Hygrometer & thermographic:
   - real-world images displaying moisture effects loss due to thermal bridges – bad building material – wrong construction process.
   - comparative images showing before-and-after scenarios with mitigation techniques applied.
   - Thermographic & hygrometer diagnosis
4. Material property charts:
   - possible humidity conditions (chronic, acute and pathological) for various construction materials.
   - tables comparing materials commonly used in construction
5. Case Studies and examples:
   - written or video case studies on building projects with moisture effects.
   - examples of successful mitigation strategies and their outcomes.
6. Handouts and worksheets:
   - summary handouts of key concepts and strategies.
   - worksheets or guided questions for students to complete during class activities, such as analyzing case studies, identifying and mitigating moisture damage.

Professional competences	**Personal and social competences**	**Language and communication competences**
Students should:		
· be able to recognize and pinpoint areas in buildings where humidity is likely to occur. This includes understanding common locations such as walls, windows, and areas where different materials meet. They should be able to analyze space or drying times in a construction to identify any weak points and understand the potential impact on the building's performance. · be capable of developing and recommending effective strategies to mitigate moisture condition problems in the construction process. This involves understanding various construction materials and relation between space-location volume and air exchange, knowledge of regulations governing ventilation. Knowledge of insulation methods and materials performances compared to air exchange. Be able to implement cost, material availability, and construction timelines in the case of any solutions proposal · gain the ability to select appropriate techniques to implement moisture comfort in the construction. This could include understanding the thermal and physic properties in all different construction materials, as well as thermal conductivity.	· **Problem-solving skills.** should enhance their abilities by thinking critically about how to address moisture and humidity issues. This includes evaluating different mitigation strategies, considering the pros and cons of various approaches, and making decisions that balance technical requirements with practical considerations – · **Collaboration and Communication**. develop the ability to collaborate effectively with peers, instructors, and professionals in the field. They should be able to communicate their findings and recommendations clearly, both in written and verbal formats, and work together with others to refine ideas and solutions for mitigating moisture and humidity issues in construction process – · **Attention to detail** cultivate strong attention to detail, enabling them to carefully examine building constructions to identify potential thermal bridges. This competence is essential for ensuring accuracy in their work and avoiding oversights that could lead to energy inefficiency in buildings –.	· be able to accurately use and understand key technical terms related to moisture and humidity, in both written and spoken communication. · be able to explain complex concepts related to humidity and moisture and their impact on health, buildings and comfort in a clear and concise manner, making the information accessible to both technical and non-technical audiences. · develop the ability to write structured, well-organized reports or summaries the details, in their proposed mitigation strategies, and the rationale behind their recommendations. · enhance their ability to present their findings and recommendations to an audience, using devices to support their explanations and ensure clarity. · practice asking relevant, insightful questions during discussions and be able to provide constructive feedback to peers, contributing to a collaborative learning environment. · improve their active listening skills, ensuring they can accurately interpret and respond to questions, critiques, and suggestions from instructors and peers during discussions or collaborative work.

· They should be able to conduct a basic analysis of material choices, comparing their performance toward humidity conditions, and make informed decisions to avoid any issues.		
Prior knowledge · basics of building construction. · basic knowledge of the physical properties of construction materials. · basic knowledge of physics · basic understanding of heat transfer. · basic knowledge of heat-related terms. · reading construction plans. · basic mathematical skills.	**Assessment** · team work; · knowledge test. · worksheets for students.	**Interdisciplinary references** · Building Physics: Understanding how heat moves through materials, including conduction, convection, and radiation, and how these principles apply to identifying and addressing thermal bridges. · Energy Efficiency and Sustainability: Understanding how moisture can influence the overall energy efficiency of buildings. · Environmental Science: Understanding the role of climate and air environmental conditions to get the appropriate moisture comfort in the building, preventing microorganisms' proliferation. · Thermal Dynamics and Heat Transfer: Knowing the basic concepts of thermal conductivity, internal conduction, convection, radiation and their impact on heat flow in building envelopes and the comfort. · Architecture: Understanding how architectural detailing can prevent or mitigate moisture and humidity issues through effective design and material selection. · Building Regulations and Standards: Knowing the building codes and standards that address thermal performance/air exchange requirements and regulations for managing air ventilation to ensure compliance and improve building air ventilation. · Construction Technology: Information on construction materials and techniques that can influence or reduce the risk of microorganism proliferation, including advanced construction materials and construction methods.
Application in the following professions: · construction technician on the basis of qualification: SEP 09 Building industry PR09-01 SQ from 09-01-01 to 09-01-07	**Levels:** · **EQF** level 3 – 4 - 5 - diploma confirming full qualification after graduating.	

Topic overview

Part 1: Introduction to thermal well-being / thermal comfort (35 minutes)

Objective: Introduce students to the topic of giving info about microclimate and thermal comfort, including impact on humans and standard regulations, supported by visual examples and case studies.

1. Introduction (**5 minutes**)

   Welcome the students and provide an overview of the lesson objectives.

2. Basics of thermal well-being and thermal comfort (**30 minutes**)

- Explain what the differences between thermal well-being and thermal comfort
- Overview on concepts of microclimatic and environmental conditions
- Key concept on risks to health and safety to workers (thermal stress) and building occupants.

Part 2: Measurement instrument and monitoring strategies (30 minutes)

Objective: Familiarize students with effective strategies to monitor and measure the conditions in the environment to recognize the conditions. Acquire skills to define the appropriate tools to be used and ability to use it.

1. Measurement instruments and monitoring strategy (**30 minutes**)

- Imparting knowledge on instruments available in the market to analyze environmental conditions.
- Practical activities using instruments to monitor thermic conditions.
- Imparting knowledge on data acquisition and data validation
- Discussion on interpretation of data and ethical consideration

Part 3: Strategies in the construction key concept on heat transfer & thermal bridges (45 minutes)

Objective: Lead students to understand how the design and the implementation of a building can be closely connected with moisture issues.

1. Planning strategies to be adopted in building construction or renovation. **(25 minutes)**

- Introduce the basics of building design in the context of local climate.
- Imparting concept of heat transfer
- Explain how thermal bridges could lead to humidity issues
- Material to be used in construction in connection with environment
- Discussions on possible solutions

2. Thermal bridges. **(20 minutes)**

- Basic overview of thermal bridges
- Overview of building envelopes and heat transfer
- Imparting knowledge on how to mitigate thermal weak points.

Part 4: Difference between humidity and moisture – connection with heat transfer (25 minutes)

Objective: Lead students to understand differences between humidity and moisture, lead them to be able to recognize the effect in a construction and be able to find solution to eliminate the issue.

1. How humidity is created – how thermal bridges are connected to the condensation and moisture issues. **(15 minutes)**

   - Definition of humidity – definition of moisture
   - Imparting knowledge on evaporation and transpiration
   - Relative humidity calculation.
   - Humidity patterns

2. Thermal bridges & connection with arising of moisture and condensation. **(10 minutes)**

   - Heat transfer mechanisms.
   - Condensation and moisture issues in connection with building envelopes and thermal bridges
   - Discussion on possible solutions to the issue
   - Case studies and application

Part 5: Humidity and diseases (45 minutes)

Objective: Lead students to detect issues connected to moisture and humidity effects, be able to measure the level in a building, understand impacts on human health and development of related diseases

1. How to measure humidity, methods and instruments for quantifying levels in the air. **(25 minutes)**

   - Introduction to humidity measurement
   - Dew point measurements
   - Calibration procedures
   - Indoor humidity monitoring.

2. Humidity and connections to health and development of related diseases. **(15 minutes)**

   - Define indoor air quality and factors contributing to indoor air quality
   - Health effects of low humidity
   - Health effect of high humidity effects
   - Mold and fungal growth – respiratory diseases

3. Conclusion and summary (5 minutes)

   Consolidate and recap of key concepts.
   Address students' queries and concerns.

Evaluation phase (25 minutes)

Let the students present their conclusions.
Assess individual statements.
Provide and check the knowledge test.

Moisture comfort

Description Reference value in time: 4 x 45 minutes

Description of the situation: The students are enrolled in a Level 4 EQF course on building construction. They have a basic understanding of moisture concepts, and they need to delve deeper into the understanding of moisture concepts such microclimate, climate and comfort, health and wellbeing, thermal comfort, human factors and thermal sensation, definition of humidity, indoor humidity monitoring, health effects with high/low humidity, mold and fungal growth, humidity and diseases.

Working task: The task for the lessons is to study the principles of humidity and moisture to learn differences between them and identify the reasons why it's formed. They will analyze how moisture and humidity affect comfort and health as well; they will understand methods to minimize their impact using different construction techniques and materials. The task concludes with case studies to reinforce their learning and apply their knowledge to real-world scenarios.

General implementation guidelines and clarifications

- clearly state the learning objectives, emphasizing the importance of understanding humidity and moisture and their impact on comfort and health.
- use thermographic and hygrometer to visually demonstrate where moisture or humidity commonly occurs, understand the actual cause and correctly diagnose the reasons that lead to the appearance of rising damp or any other type of damp in a home.
- include a brief review of the causes of the humidity rising in construction materials, highlighting those prone to creating moisture problems.
- provide case studies or examples from real-world building projects that show the consequences of poor moisture management.
- discuss various theoretical mitigation techniques, enhanced insulation strategies, and improved construction details.
- encourage students to engage in discussions about the challenges of identifying and mitigating moisture problems in different building designs.
- conclude with a summary of key concepts, followed by a task where students write a brief explanation of how they would apply these principles in a hypothetical construction scenario.
- allocate time for reflection and discussion to allow students to process information, ask questions, and share insights.

Teaching materials

7. PowerPoint presentation:
- slides covering key concepts of moisture and humidity and their effects on comfort and health leading to diseases; overview on mitigation strategies.

8. Visual aids:
- diagrams showing locations in building structures with effects arising from humidity and moisture.
- cross-sectional illustrations of building elements highlighting moisture and humidity effects.

9. Hygrometer & thermographic:
- real-world images displaying moisture effects loss due to thermal bridges – bad building material – wrong construction process.
- comparative images showing before-and-after scenarios with mitigation techniques applied.
- Thermographic & hygrometer diagnosis

10. Material property charts:
- possible humidity conditions (chronic, acute and pathological) for various construction materials.
- tables comparing materials commonly used in construction

11. Case Studies and examples:
- written or video case studies on building projects with moisture effects.
- examples of successful mitigation strategies and their outcomes.

12. Handouts and worksheets:
- summary handouts of key concepts and strategies.
- worksheets or guided questions for students to complete during class activities, such as analyzing case studies, identifying and mitigating moisture damage.

Professional competences	**Personal and social competences**	**Language and communication competences**
Students should:		
· be able to recognize and pinpoint areas in buildings where humidity is likely to occur. This includes understanding common locations such as walls, windows, and areas where different materials meet. They should be able to analyze space or drying times in a construction to identify any weak points and understand the potential impact on the building's performance. · be capable of developing and recommending effective strategies to mitigate moisture condition problems in the construction process. This involves understanding various construction materials and relation between space-location volume and air exchange, knowledge of regulations governing ventilation. Knowledge of insulation methods and materials performances compared to air exchange. Be able to implement cost, material availability, and construction timelines in the case of any solutions proposal · gain the ability to select appropriate techniques to implement moisture comfort in the construction. This could include understanding the thermal and physic properties in all different construction materials, as well as thermal conductivity. ·	· **Problem-solving skills.** should enhance their abilities by thinking critically about how to address moisture and humidity issues. This includes evaluating different mitigation strategies, considering the pros and cons of various approaches, and making decisions that balance technical requirements with practical considerations – · **Collaboration and Communication**. develop the ability to collaborate effectively with peers, instructors, and professionals in the field. They should be able to communicate their findings and recommendations clearly, both in written and verbal formats, and work together with others to refine ideas and solutions for mitigating moisture and humidity issues in construction process – · **Attention to detail** cultivate strong attention to detail, enabling them to carefully examine building constructions to identify potential thermal bridges. This competence is essential for ensuring accuracy in their work and avoiding oversights that could lead to energy inefficiency in buildings –.	· be able to accurately use and understand key technical terms related to moisture and humidity, in both written and spoken communication. · be able to explain complex concepts related to humidity and moisture and their impact on health, buildings and comfort in a clear and concise manner, making the information accessible to both technical and non-technical audiences. · develop the ability to write structured, well-organized reports or summaries the details, in their proposed mitigation strategies, and the rationale behind their recommendations. · enhance their ability to present their findings and recommendations to an audience, using devices to support their explanations and ensure clarity. · practice asking relevant, insightful questions during discussions and be able to provide constructive feedback to peers, contributing to a collaborative learning environment. · improve their active listening skills, ensuring they can accurately interpret and respond to questions, critiques, and suggestions from instructors and peers during discussions or collaborative work.

· They should be able to conduct a basic analysis of material choices, comparing their performance toward humidity conditions, and make informed decisions to avoid any issues.		
Prior knowledge · basics of building construction. · basic knowledge of the physical properties of construction materials. · basic knowledge of physics · basic understanding of heat transfer. · basic knowledge of heat-related terms. · reading construction plans. · basic mathematical skills.	**Assessment** · team work; · knowledge test. · worksheets for students.	**Interdisciplinary references** · Building Physics: Understanding how heat moves through materials, including conduction, convection, and radiation, and how these principles apply to identifying and addressing thermal bridges. · Energy Efficiency and Sustainability: Understanding how moisture can influence the overall energy efficiency of buildings. · Environmental Science: Understanding the role of climate and air environmental conditions to get the appropriate moisture comfort in the building, preventing microorganisms' proliferation. · Thermal Dynamics and Heat Transfer: Knowing the basic concepts of thermal conductivity, internal conduction, convection, radiation and their impact on heat flow in building envelopes and the comfort. · Architecture: Understanding how architectural detailing can prevent or mitigate moisture and humidity issues through effective design and material selection. · Building Regulations and Standards: Knowing the building codes and standards that address thermal performance/air exchange requirements and regulations for managing air ventilation to ensure compliance and improve building air ventilation. · Construction Technology: Information on construction materials and techniques that can influence or reduce the risk of microorganism proliferation, including advanced construction materials and construction methods.
Application in the following professions: · construction technician on the basis of qualification: SEP 09 Building industry PR09-01 SQ from 09-01-01 to 09-01-07	**Levels:** · **EQF** level 3 – 4 - 5 - diploma confirming full qualification after graduating.	

Topic overview

Part 1: Introduction to thermal well-being / thermal comfort (35 minutes)

Objective: Introduce students to the topic of giving info about microclimate and thermal comfort, including impact on humans and standard regulations, supported by visual examples and case studies.

3. Introduction (**5 minutes**)

   Welcome the students and provide an overview of the lesson objectives.

4. Basics of thermal well-being and thermal comfort (**30 minutes**)

- Explain what the differences between thermal well-being and thermal comfort
- Overview on concepts of microclimatic and environmental conditions
- Key concept on risks to health and safety to workers (thermal stress) and building occupants.

Part 2: Measurement instrument and monitoring strategies (30 minutes)

Objective: Familiarize students with effective strategies to monitor and measure the conditions in the environment to recognize the conditions. Acquire skills to define the appropriate tools to be used and ability to use it.

2. Measurement instruments and monitoring strategy (**30 minutes**)

- Imparting knowledge on instruments available in the market to analyze environmental conditions.
- Practical activities using instruments to monitor thermic conditions.
- Imparting knowledge on data acquisition and data validation
- Discussion on interpretation of data and ethical consideration

Part 3: Strategies in the construction key concept on heat transfer & thermal bridges (45 minutes)

Objective: Lead students to understand how the design and the implementation of a building can be closely connected with moisture issues.

3. Planning strategies to be adopted in building construction or renovation. **(25 minutes)**

- Introduce the basics of building design in the context of local climate.
- Imparting concept of heat transfer
- Explain how thermal bridges could lead to humidity issues
- Material to be used in construction in connection with environment
- Discussions on possible solutions

4. Thermal bridges. **(20 minutes)**

- Basic overview of thermal bridges
- Overview of building envelopes and heat transfer
- Imparting knowledge on how to mitigate thermal weak points.

Part 4: Difference between humidity and moisture – connection with heat transfer (25 minutes)

Objective: Lead students to understand differences between humidity and moisture, lead them to be able to recognize the effect in a construction and be able to find solution to eliminate the issue.

3. How humidity is created – how thermal bridges are connected to the condensation and moisture issues. **(15 minutes)**

   - Definition of humidity – definition of moisture
   - Imparting knowledge on evaporation and transpiration
   - Relative humidity calculation.
   - Humidity patterns

4. Thermal bridges & connection with arising of moisture and condensation. **(10 minutes)**

   - Heat transfer mechanisms.
   - Condensation and moisture issues in connection with building envelopes and thermal bridges
   - Discussion on possible solutions to the issue
   - Case studies and application

Part 5: Humidity and diseases (45 minutes)

Objective: Lead students to detect issues connected to moisture and humidity effects, be able to measure the level in a building, understand impacts on human health and development of related diseases

4. How to measure humidity, methods and instruments for quantifying levels in the air. **(25 minutes)**
   - Introduction to humidity measurement
   - Dew point measurements
   - Calibration procedures
   - Indoor humidity monitoring.

5. Humidity and connections to health and development of related diseases. **(15 minutes)**
   - Define indoor air quality and factors contributing to indoor air quality
   - Health effects of low humidity
   - Health effect of high humidity effects
   - Mold and fungal growth – respiratory diseases

6. Conclusion and summary (5 minutes)

   Consolidate and recap of key concepts.
   Address students' queries and concerns.

Evaluation phase (25 minutes)

Let the students present their conclusions.
Assess individual statements.
Provide and check the knowledge test.

Introduction to thermal comfort

Introduction to thermal comfort

Description Reference value in time: 2 x 45 minutes

Description of the situation: The students are first or second year building construction students (level 4). They don't have much knowledge about the thermal comfort in a building

Working task: The aim is that after the lessons, students will understand the importance of thermal comfort and factors that contribute to it.

General implementation guidelines and clarifications

- Express learning objectives, emphasizing the impact of thermal comfort in construction
- Using images to show different sources of moisture
- provide case studies or examples from real-world building projects.
- as an exercise in how to identify important sources of heat and cold in buildings from the perspective of thermal comfort.
- discussion on the topic and asking questions about the topic

Teaching materials

- Powerpoint presentation: covers the introduction to the thermal comfort.
- Visual aids: pictures and videos of how to minimize damages from moisture sources
- Case studies and examples
- Group work

Professional competence	**Personal and social competence**	**Language and communication competences**
Students should:		
· know different sources of heat and cold in the buildings · Identify regognize these sources and how they affect to the people.	· Collaboration and Communication	· communicate with other students and the teacher · improve their active listening skills
Prior knowledge · basic knowledge in the use of digital devices · previous knowledge of basic construction	**Assessment** · team work · Knowledge test	**Interdisciplinary references** ·

Application in the following professions:	**Levels:**
Housebuilder	· **4**

Topic overview

Part 1: Introduction to the thermal comfort (45 minutes)

Objective: Introduce students to the topic

6. Lesson from “Introduction to the thermal comfort”-powerpoint (25 minutes)
7. Discussion about teaching materials (10 minutes)
8. Knowledge test (5 minutes)

Determination of adequate building materials for component layers Wall-floor-ceiling

LS:	**HEALTHY BUILDING** **Determination of adequate building materials for component layers Wall-floor-ceiling**
Description of the Learning Scenario (LS):	**Time limit: 24 hours**

Situation description: Determination of the "closed shell" component layers of a residential building. (new build or existing building)

Work task:

- Selection of building materials for the individual component layers,
- Calculation of the service life of the component layers using an officially recognised tool,
- Checking the thermal transmittance value in accordance with the applicable GEE regulations,
- Determination of the environmental score and its impact on the environment,
- If necessary, optimise the service life, thermal transmittance and environmental score,
- *Comparison with the "produit Biosourcé" label and knowledge of the authorisation (not yet mandatory by the state)*

General implementation instructions and explanations

State-approved free "Tools" programmes are used for the implementation. Implementation of the learning unit as group work for:

- Selection of building materials for the individual component layers,
- *Comparison with the "produit Biosourcé" label and knowledge of the authorisation (not yet mandatory by the state)*

Implementation of the learning unit as individual work for:

- Calculation of the service life of the component layers using an officially recognised tool,
- Checking the thermal transmittance value in accordance with the applicable GEE regulations,
- Determination of the environmental score and its impact on the environment,
- If necessary, optimise the service life, thermal transmittance and environmental score,

Teaching materials

- Digital end devices (laptop, PC)
- School software for the creation of component layers "or freehand sketches"
- Soft or "free" goods for calculations "TOTEM, GRO", etc....
- Storage medium (cloud, USB)
- Information materials (TEAMS platform)

Expertise	**Linguistic & communicative competence**
The pupils ...	

• ...are able to efficiently determine healthy building materials for corresponding component layers, • ...are able to enter the designed component layers into an appropriate tool to determine their service life and environmental score • ...are able to compare the thermal transmittance values of the component layers with the applicable GEE regulations, • ...are able to initiate optimisations independently. • *...are able to label the determined component layers with the label "produit Biosourcé" and to optimise the process.* *to make an effort,* ○ *are able to compare the determined component layers with the "produit Biosourcé" label and initiate optimisations,*		• ... communicate with those involved within the group, • ... compiling information on the structural features • ... correct use of technical terms and software,
Previous knowledge	**Valuation**	**Interdisciplinary notes**
▪ Basic knowledge of using a laptop and PC, ▪ Basic knowledge of "green buildings, natural raw materials, environmental pollution, ▪ Expertise in building physics ▪ Expertise in energy efficiency and the use of renewable energies, ▪ Specialist knowledge of environmental protection and the influence of building materials, ▪ Written language skills,	▪ correct use of the tools, ▪ Text data, ▪ Handling the equipment and teamwork,	▪
Evaluation -The students are able to independently determine ecological and healthy component layers.		

Structure of the learning unit: Determination of suitable building materials for the component layer of a classic pitched roof

A: Work task:

2. Selection of building materials for the individual component layers,
3. Calculation of the service life of the component layers using an officially recognised tool,
4. Checking the thermal transmittance value in accordance with the applicable GEE regulations,
5. Determination of the environmental score and its impact on the environment,
6. If necessary, optimise the service life, thermal transmittance and environmental score,
7. *Comparison with the "produit Biosourcé" label and knowledge of the authorisation (not yet mandatory by the state)*

B: General implementation instructions and explanations:

- Realisation in groups or individual work,

C: Teaching materials:

- The following instruments are used in lessons:
  - Digital end devices (laptop, PC),
  - School software for the creation of component layers "or freehand sketches"
  - Soft or "free" goods for calculations "TOTEM, GRO", etc....
  - Storage medium (cloud, USB)
  - Information platform (TEAMS)

D: Evaluation - Feedback - Resonance:

- The students are able to read in the models independently, to orientate themselves three-dimensionally and to carry out the task three-dimensionally.
  - are able to efficiently determine healthy building materials for corresponding component layers,
  - are able to enter the designed component layers into an appropriate tool to determine their service life and environmental score
  - are able to compare the thermal transmittance values of the component layers with the applicable GEE regulations,
  - are able to initiate optimisations independently.

E: Exemplary example of the work:

- On the basis of the detailed drawing template, the students determine:
  - The materials of the individual component layers,
  - You enter the building materials in the TOTEM software,
  - They derive the service life of the building materials,
  - You determine the environmental score and its impact on the environment,
  - They determine the thermal transmittance values and improve them according to GEE requirements

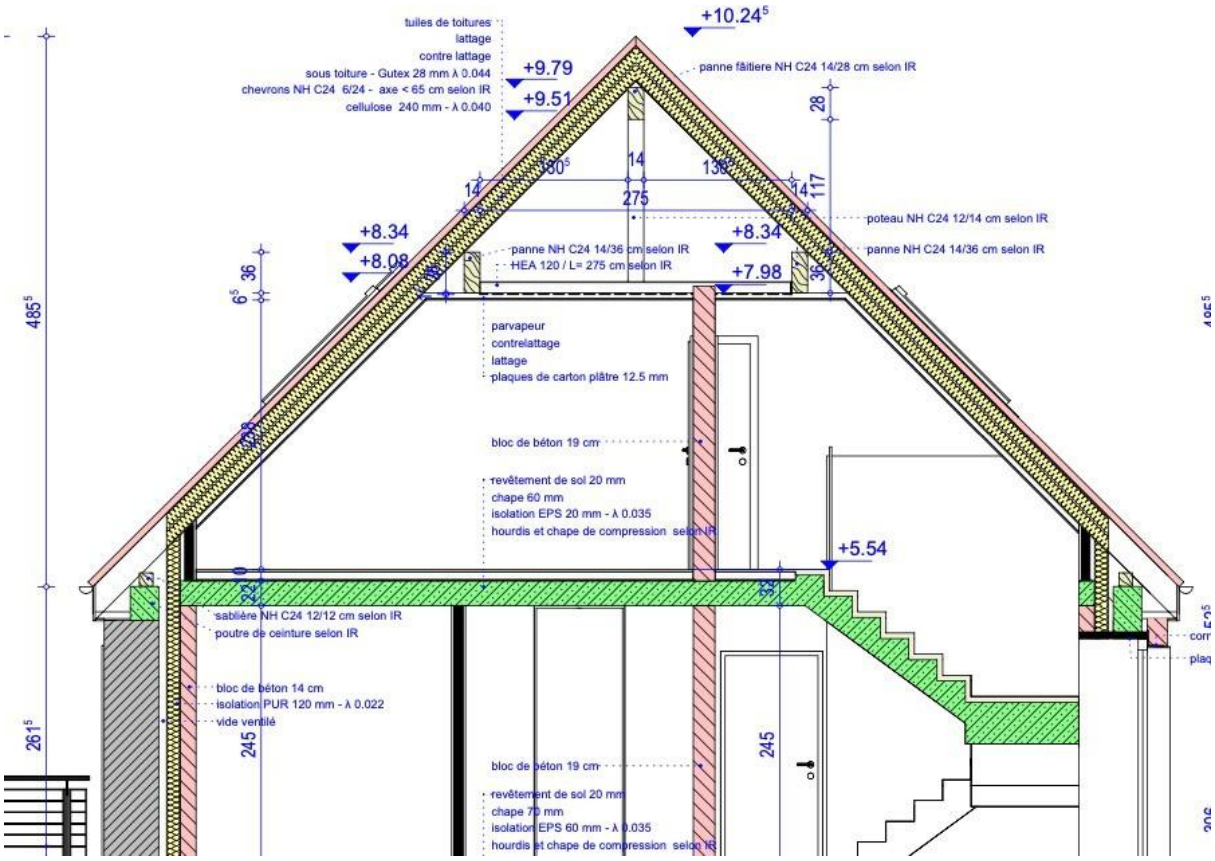
HEALTHY BUILDING
Determination of adequate building materials for wall-floor-ceiling component layers

	Work tasks	Lessons of 50 minutes each.	
	1Selecting the individual component layers	**1**	**St**
2	**Calculation of the service life of the Component layers, input of component data**	**7**	**St**
	Checking the thermal transmittance values with 3the applicable regulations and adequate adjustments	**4**	**St**
	Determination of the environmental performance indicator and its impact on the environment	**4**	**St**
	Optimisation of service life, environmental performance indicator, thermal transmittance	**4**	**St**
4	*cComparison with the "produit biosourcé" label*	*4*	*St*
	Total benchmark	24	St

=

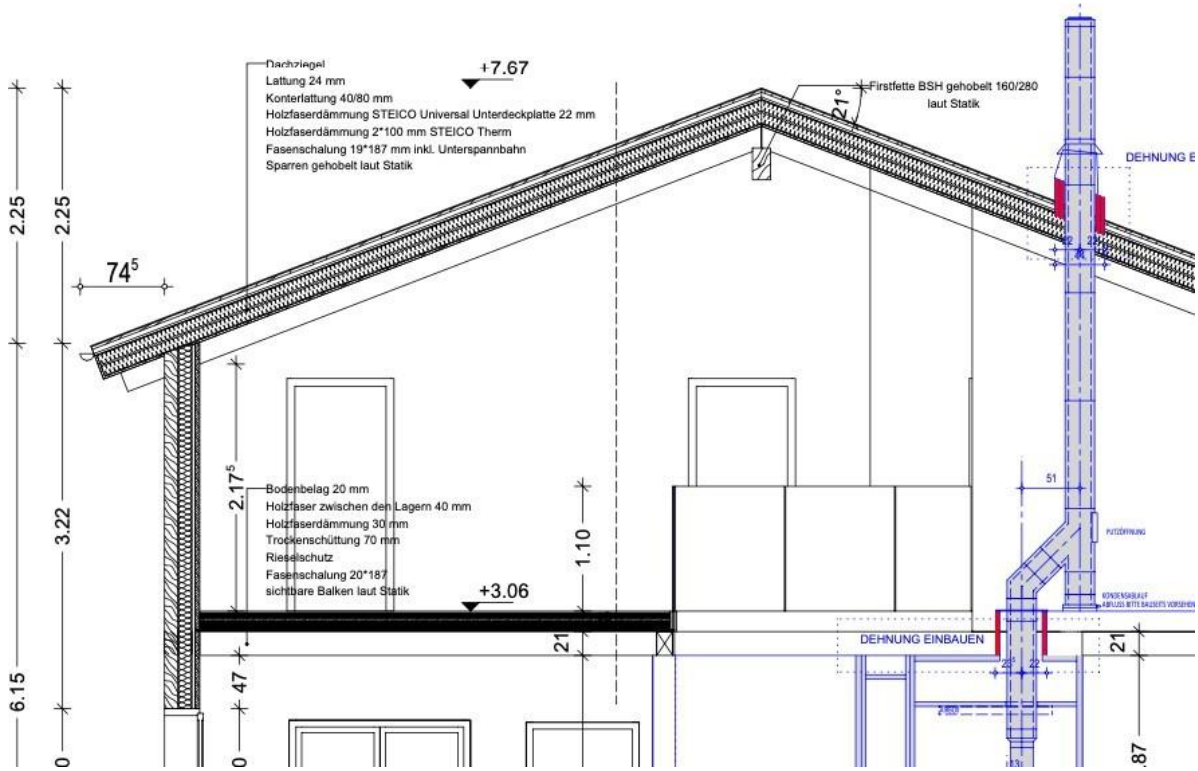
1: Selection of the individual component layers - time reference value 1 pc.

1a: Classic rafter roof:



- GK panels
- Support battens
- Battens
- Vapour barrier/retarder
- Rafter 24/8 cm
- Mineral wool insulation
- Bituminised wood fibre insulation / underlay membrane
- Counter battens
- Battens
- Roof tiles

1b: Classic rafter roof with ecological building materials:



- Visible board formwork

- Rafters 20/8 cm

- Wood fibre insulation 2*100 mm

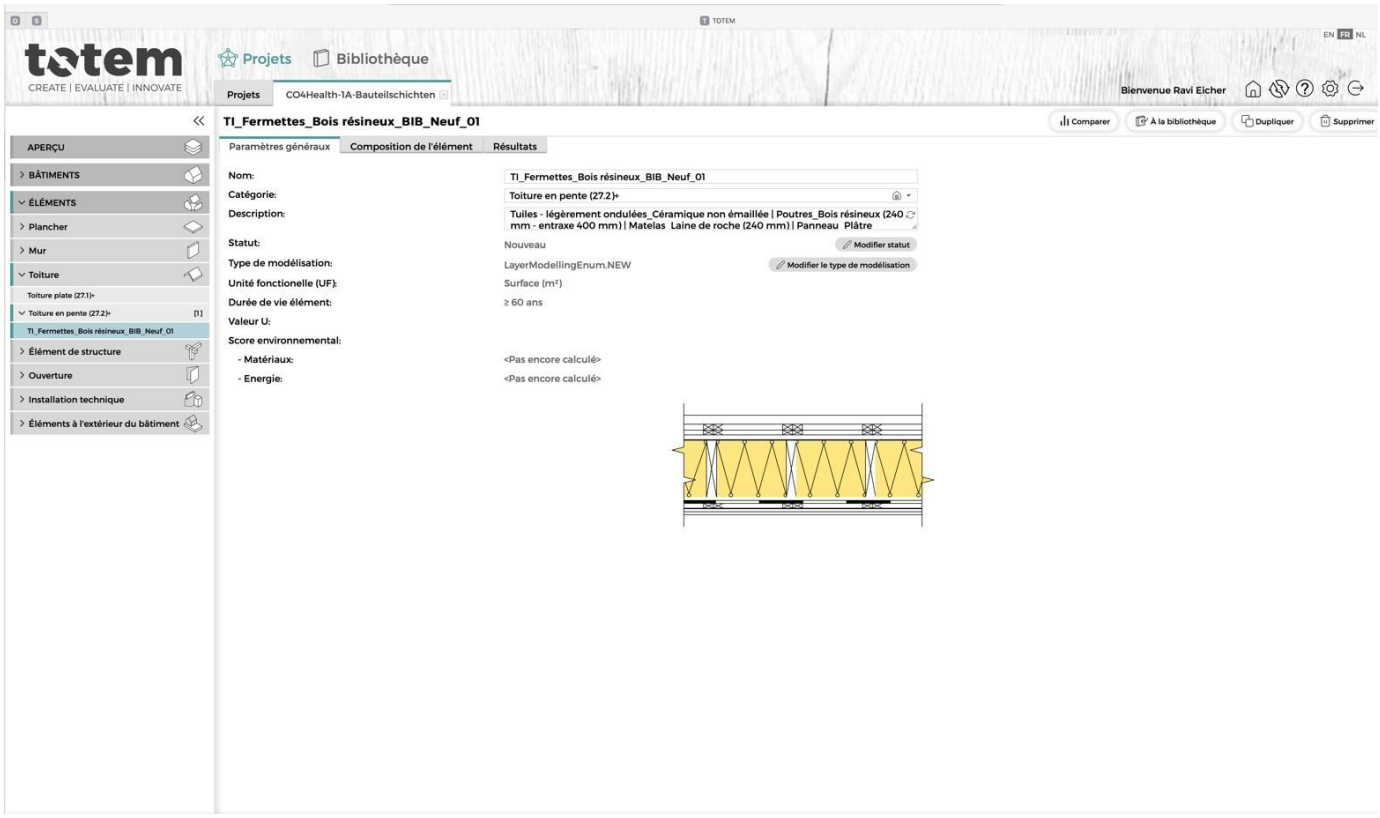
- Wood fibre insulation - underlay board 22 mm
- Counter battens 40/80 mm

- Battens 24/30 mm
- Roof tiles

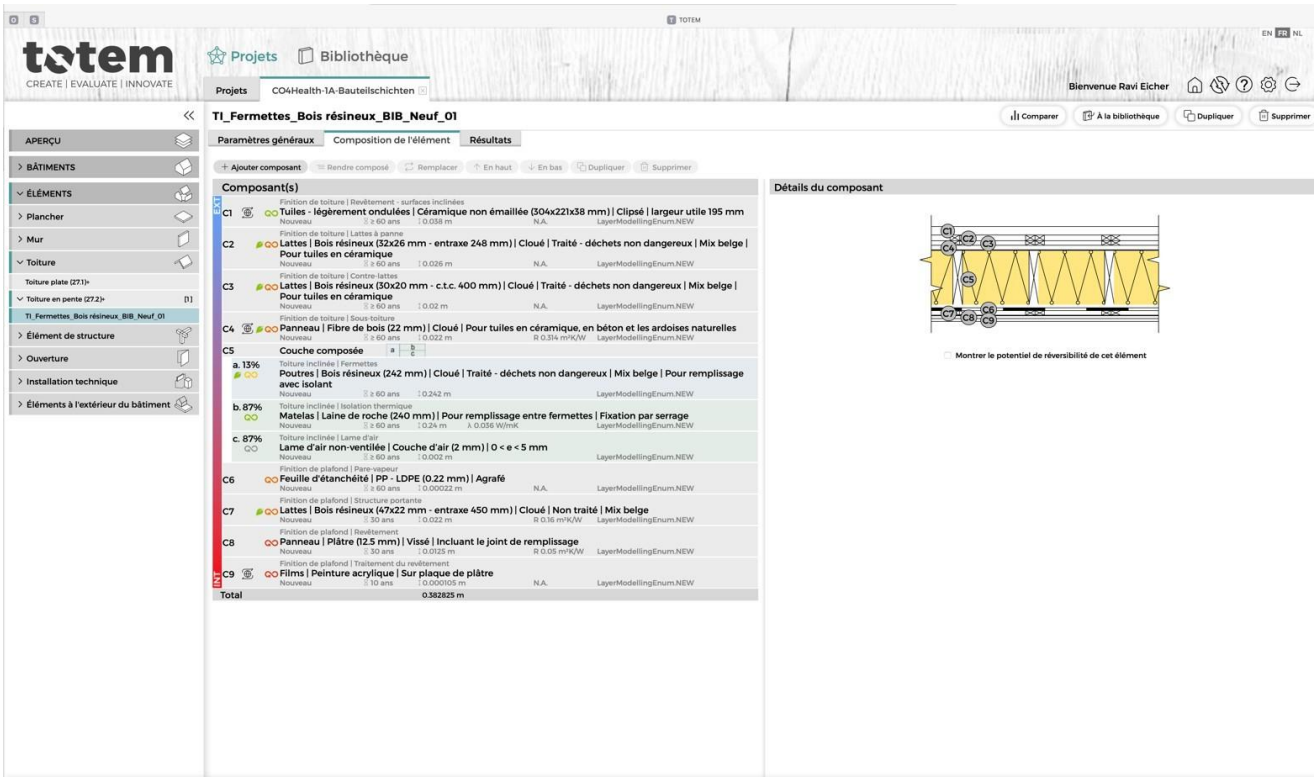
2: Calculation of the service life of the component layers - time reference value 7 pcs.

1a. Classic rafter roof:

Enter the roof type:



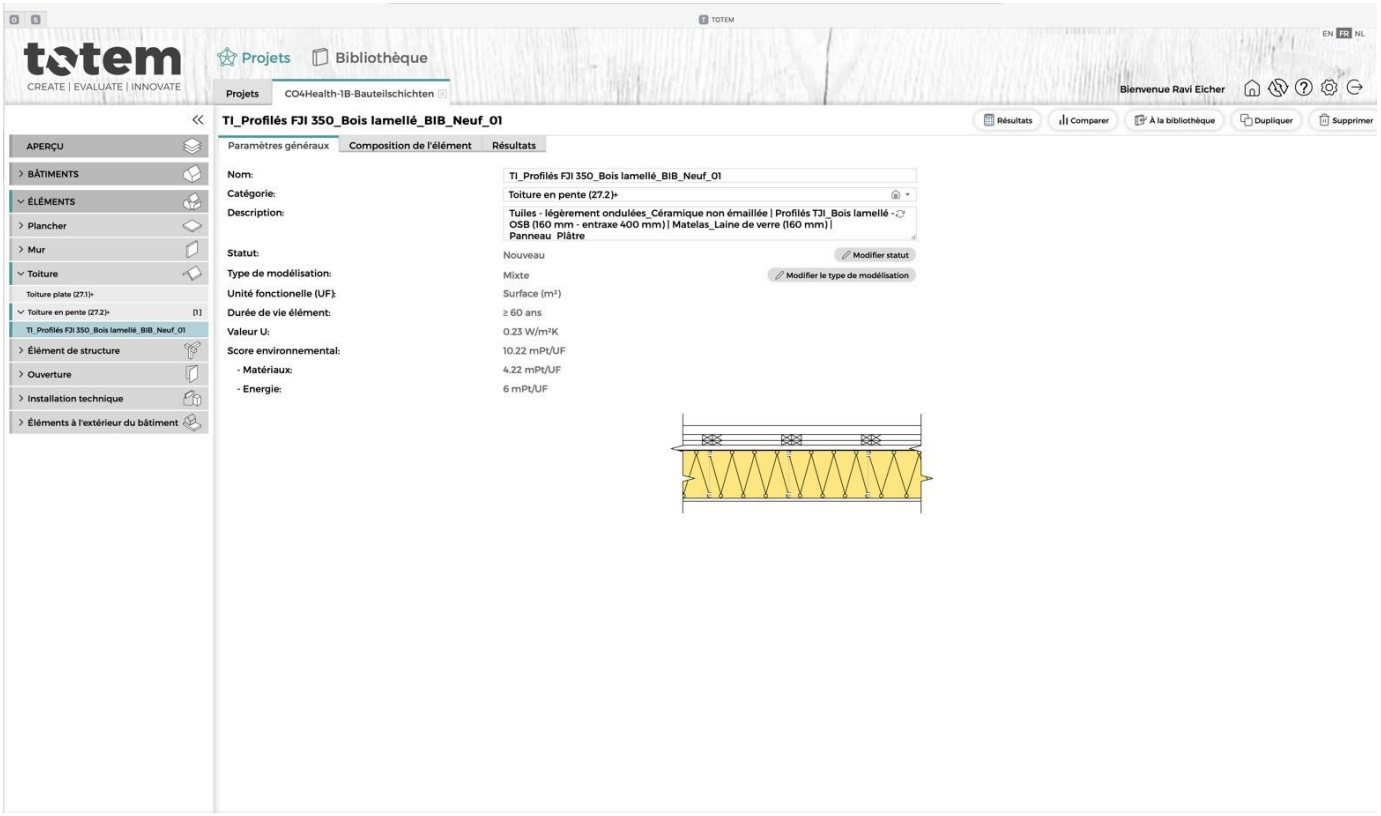
Input of all component layers:



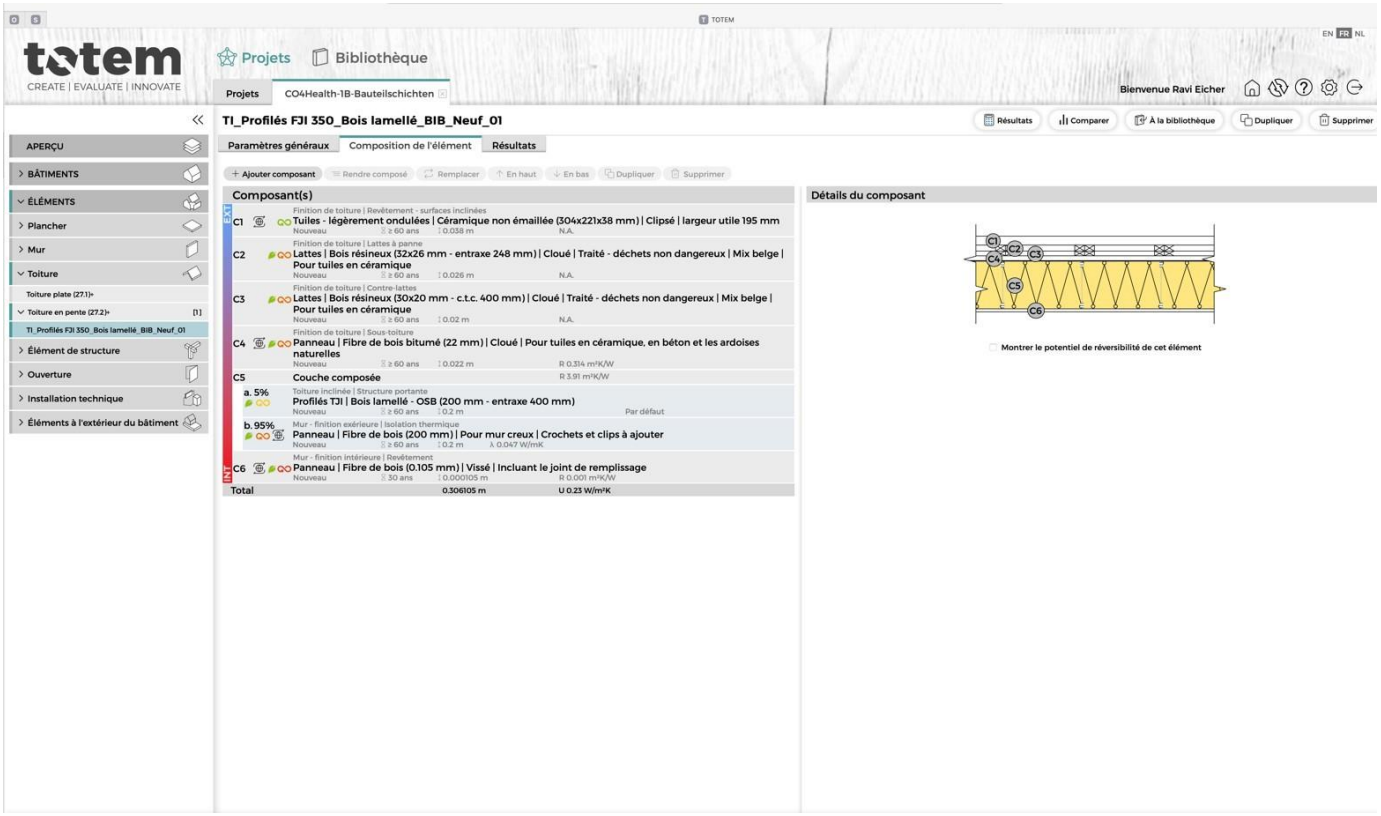
Results:

1b. Classic rafter roof with ecological building materials:

Enter the roof type:



Input of all component layers:



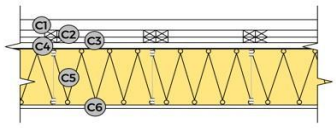
Results:

Checking the thermal transmittance values against the applicable regulations

Time reference value 4 hours

Détails de l'élément | **Résultats**

Nom:	TI_Profilés FJI 350_Bois lamellé_BIB_Neuf_01
Categorie:	Toiture en pente (27.2)+
Description:	Tuiles - légèrement ondulées_Céramique non émaillée | Profilés TJI_Bois lamellé - OSB (160 mm - entraxe 400 mm) | Matelas_Laine de verre (160 mm) | Panneau_Plâtre
Statut:	Nouveau
Unité fonctionnelle (UF):	Surface (m²)
Durée de vie élément:	≥ 60 ans
Valeur U:	0.23 W/m²K
Score environnemental total:	10.22 mPt/UF
- Matériaux:	4.22 mPt/UF
- Energie:	6 mPt/UF

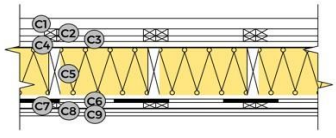


Montrer le potentiel de réversibilité de cet élément

C1		Tuiles - légèrement ondulées | Céramique non émaillée (304x221x38 mm)
C2		Lattes | Bois résineux (32x26 mm - entraxe 248 mm)
C3		Lattes | Bois résineux (30x20 mm - c.t.c. 400 mm)
C4		Panneau | Fibre de bois bitumé (22 mm)
C5		Couche composée
	a.	Profilés TJI | Bois lamellé - OSB (200 mm - entraxe 400 mm)
	b.	Panneau | Fibre de bois (200 mm)
C6		Panneau | Fibre de bois (0.105 mm)

Détails de l'élément | **Résultats**

Nom:	TI_Fermettes_Bois résineux_BIB_Neuf_01
Categorie:	Toiture en pente (27.2)+
Description:	Tuiles - légèrement ondulées_Céramique non émaillée | Poutres_Bois résineux (172 mm entraxe 400 mm) | Matelas_Laine de roche (170 mm) | Panneau_Plâtre
Statut:	Nouveau
Unité fonctionnelle (UF):	Surface (m²)
Durée de vie élément:	≥ 60 ans
Valeur U:	0.23 W/m²K
Score environnemental total:	11.05 mPt/UF
- Matériaux:	4.9 mPt/UF
- Energie:	6.15 mPt/UF



Montrer le potentiel de réversibilité de cet élément

C1		Tuiles - légèrement ondulées | Céramique non émaillée (304x221x38 mm)
C2		Lattes | Bois résineux (32x26 mm - entraxe 248 mm)
C3		Lattes | Bois résineux (30x20 mm - c.t.c. 400 mm)
C4		Panneau | Fibre de bois (22 mm)
C5		Couche composée a b c
	a.	Poutres | Bois résineux (172 mm)
	b.	Matelas | Laine de roche (170 mm)
	c.	Lame d'air non-ventilée | Couche d'air (2 mm)
C6		Feuille d'étanchéité | PP - LDPE (0.22 mm)
C7		Lattes | Bois résineux (47x22 mm - entraxe 450 mm)
C8		Panneau | Plâtre (12.5 mm)
C9		Films | Peinture acrylique

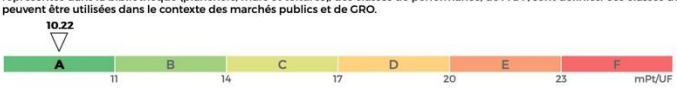
Determination of the environmental score and its impact on the environmental Time reference value 4 hours

Détails de l'élément | Résultats

Résultats détaillés

Score environnemental

Le graphique ci-dessous montre le score environnemental de votre élément par rapport à une échelle de valeur indicative. L'échelle de valeur a été développée sur base du score environnemental de tous les éléments de la même catégorie disponibles dans la bibliothèque. Pour les éléments bie représentés dans la bibliothèque (planchers, murs et toitures), des classes de performance, de A à F, sont définies. Ces classes de performance peuvent être utilisées dans le contexte des marchés publics et de GRO.



Impact par composant

Avertissement :

- Dans la version actuelle, les différentes catégories d'impacts environnementaux sont normalisées et pondérées en un score unique via le scc des externalités environnementales (voir les résultats détaillés pour plus de details).
- Le contenu recyclé des composants est pris en compte dans TOTEM; par contre, les bénéfices nets et les impacts du potentiel de réemploi, c récupération d'énergie et du potentiel de recyclabilité au-delà du cycle de vie du bâtiment, ne sont pas encore pris en compte mais seront intégrés dans une version ultérieure de TOTEM. Le futur réemploi d'éléments ou de composants peut induire une réduction significative de l'impact environnemental à plus long terme.
- Afin d'effectuer de bonnes comparaisons entre différentes variantes de bâtiment, il est important de comparer des variantes ayant des performances techniques similaires en termes de valeur U, de performances acoustiques, de résistance au feu, etc.
- Certaines catégories d'éléments, incluant les escaliers, les fondations, les balcons et les installations électriques, ne sont actuellement pas inclues dans TOTEM et seront ajoutées dans les versions futures. L'impact environnemental est donc à l'heure actuelle sous-estimé.

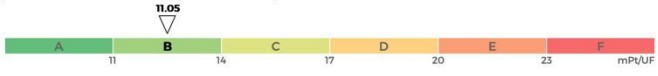
Findings on the environmental score

Détails de l'élément | Résultats

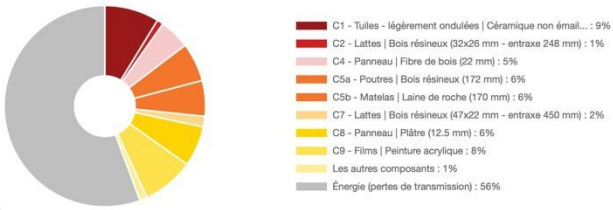
Résultats détaillés

Score environnemental

Le graphique ci-dessous montre le score environnemental de votre élément par rapport à une échelle de valeur indicative. L'échelle de valeur a été développée sur base du score environnemental de tous les éléments de la même catégorie disponibles dans la bibliothèque. Pour les éléments bie représentés dans la bibliothèque (planchers, murs et toitures), des classes de performance, de A à F, sont définies. Ces classes de performance peuvent être utilisées dans le contexte des marchés publics et de GRO.



Impact par composant



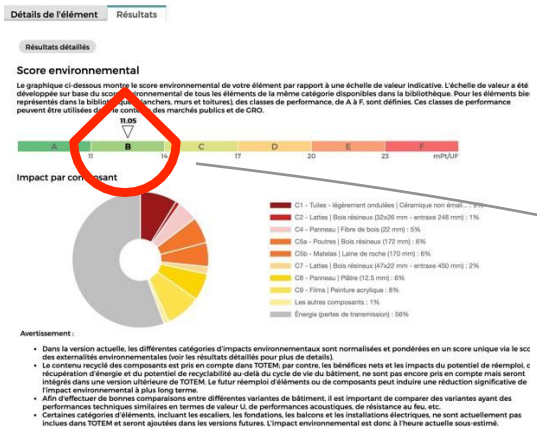
Avertissement :

- Dans la version actuelle, les différentes catégories d'impacts environnementaux sont normalisées et pondérées en un score unique via le scc des externalités environnementales (voir les résultats détaillés pour plus de details).
- Le contenu recyclé des composants est pris en compte dans TOTEM; par contre, les bénéfices nets et les impacts du potentiel de réemploi, c récupération d'énergie et du potentiel de recyclabilité au-delà du cycle de vie du bâtiment, ne sont pas encore pris en compte mais seront intégrés dans une version ultérieure de TOTEM. Le futur réemploi d'éléments ou de composants peut induire une réduction significative de l'impact environnemental à plus long terme.
- Afin d'effectuer de bonnes comparaisons entre différentes variantes de bâtiment, il est important de comparer des variantes ayant des performances techniques similaires en termes de valeur U, de performances acoustiques, de résistance au feu, etc.
- Certaines catégories d'éléments, incluant les escaliers, les fondations, les balcons et les installations électriques, ne sont actuellement pas inclues dans TOTEM et seront ajoutées dans les versions futures. L'impact environnemental est donc à l'heure actuelle sous-estimé.

5: Optimisation of service life, environmental score and thermal transmittance – Time reference value 4 pcs.

ROOF

MINERAL WOOL INSULATION / Environmental score 11.06 / U=0.023W/m2.K

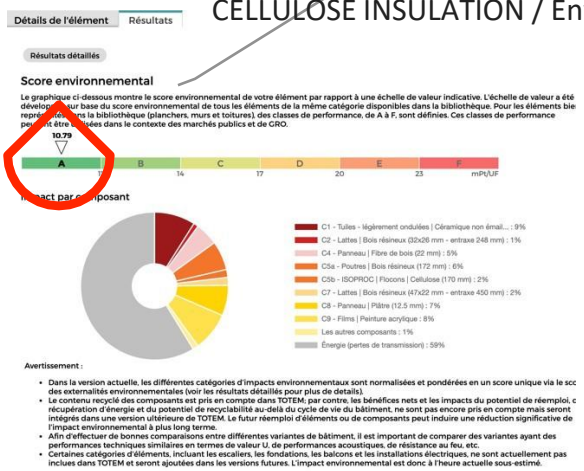


OPTIMISATION OF THE INSULATION

Environmental score "B"

The following graph shows the environmental score of your item compared to an indicative value scale. The value scale has been developed based on the environmental score of all elements of the same category available in the library. Performance classes from A to F are defined for the elements well represented in the library (floors, walls and roofs). These performance classes can be used in the context of public procurement and GROs.

CELLULOSE INSULATION / Environmental score 10.79 / U=0.024W/m2.K

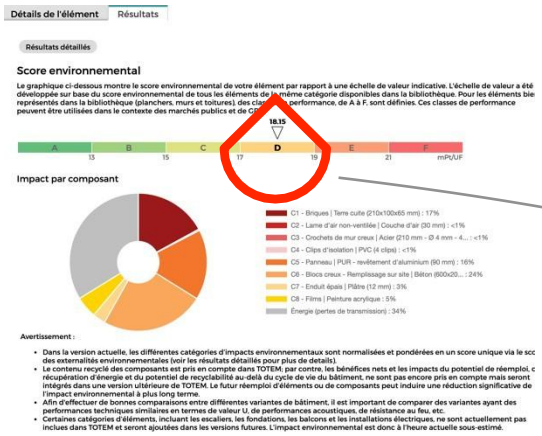


Environmental score "A

The following graph shows the environmental score of your item compared to an indicative value scale. The value scale has been developed based on the environmental score of all elements of the same category available in the library. Performance classes from A to F are defined for the elements well represented in the library (floors, walls and roofs). These performance classes can be used in the context of public procurement and GROs.

WALL

Mixed masonry / environmental score 18.15 / U=0.023W/m2.K

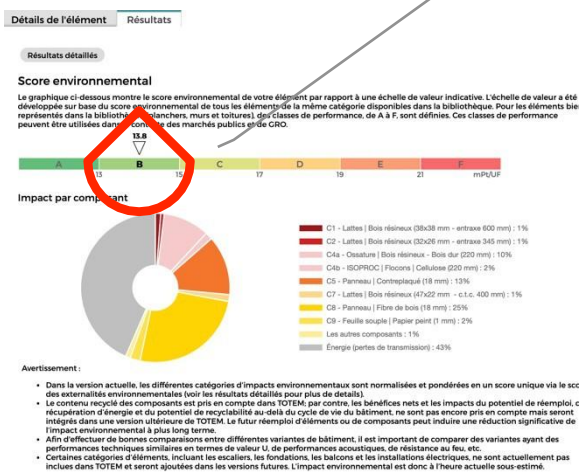


Environmental score "D"

OPTIMISATION OF THE CONSTRUCTION METHOD

The following graph shows the environmental score of your item compared to an indicative value scale. The value scale has been developed based on the environmental score of all elements of the same category available in the library. Performance classes from A to F are defined for the elements well represented in the library (floors, walls and roofs). These performance classes can be used in the context of public procurement and GROs.

WOOD STANDARD CONSTRUCTION / Environmental score 13.8 / U=0.023W/m2.K



Environmental score "B"

The following graph shows the environmental score of your item compared to an indicative value scale. The value scale has been developed based on the environmental score of all elements of the same category available in the library. Performance classes from A to F are defined for the elements well represented in the library (floors, walls and roofs). These performance classes can be used in the context of public procurement and GROs.

Correct Installation of thermal insulation

Correct installation of thermal insulation

Description Reference value in time: 2 x 45 minutes

Description of the situation: The students are enrolled in a Level 4 EQF course on building construction. They have a basic understanding of thermal concepts but they should put theoretical knowledge into practice.

Working task: The task for this lesson is for students to understand the importance of insulation and safety, hands-on installation of wood fiber boards, and troubleshooting common issues. Across two 45-minute parts, students engage in theory, practical activities, and collaborative discussions to build technical skills and ecological awareness.

General implementation guidelines and clarifications

- divide the lesson into two parts (45 minutes each) to balance theoretical understanding and practical application. This structure ensures the students maintain focus and fully grasp the concepts before moving to hands-on activities;
- conduct the lessons in a vocational workshop or laboratory with appropriate tools, materials, and protective gear. Ensure all students have access to mock walls and wood fiber board samples;
- emphasize safety precautions at the beginning of the lesson. Students should wear protective gear (e.g., gloves, masks) and be familiar with tool handling. Always keep a first aid kit accessible;
- divide students into small groups (3–4 per group) to promote teamwork and allow effective supervision during hands-on activities;
- allocate specific time slots for each activity, ensuring enough time for demonstrations, individual/group work, and discussions.;
- provide clear instructions on how to handle materials (e.g., cutting wood fiber boards accurately) and allow students to access digital resources (e.g., videos or diagrams) if required;
- focus on both the technical skills (installation of wood fiber boards) and conceptual understanding (importance of thermal insulation and environmental benefits). Balance theoretical and practical activities;
- combine observation, self-assessment forms, peer feedback, and teacher-led discussions to evaluate students' understanding and performance;
- use the troubleshooting activity not only to highlight mistakes but to encourage critical thinking and collaborative problem-solving among students;
- summarize best practices and key takeaways to reinforce learning objectives. Encourage students to share what they've learned;
- provide structured evaluation forms for self-assessment and peer feedback. Assess the students' ability to apply the installation techniques, their teamwork, and their understanding of the concepts.

Teaching materials

13. Visual presentation materials:
- diagrams showing the structure of wooden frame walls, placement of wood fiber boards, and airtight sealing techniques;
- short presentation summarizing key steps, safety protocols, and troubleshooting tips for insulation.

14. Practical tools and resources:
- mock walls/ceilings: sample structures for hands-on activities physical samples of various insulation materials, such as fiberglass batts, foam boards, cellulose, mineral wool, and reflective insulation;
- insulation materials: supply wood fiber boards along with related materials like fasteners, sealants, and protective gear allow students to touch and examine the texture, density, and other physical properties of each material;
- cutting and measuring tools: ensure availability of tape measures, cutting knives, and straight edges.

15. Handouts and worksheets:
- step-by-step guides: printed or digital material outlining proper installation techniques, measuring tips, and ways to avoid common errors;
- assessment forms: include self-assessment checklists for students to evaluate their performance and reflect on their learning;
- safety protocols handout: highlight key precautions for handling tools and materials.

16. Video tutorials (optional):
- short instructional videos demonstrating the installation of thermal insulation, focusing on cutting, attaching, and sealing wood fiber boards.

17. Interactive teaching tools:
- online resources: links or QR codes to articles or videos about the benefits of thermal insulation and eco-friendly construction;
- problem-solving scenarios: interactive cards or slides presenting troubleshooting situations for students to resolve during the lesson.

Professional competence	**Personal and social competence**	**Language and communication competences**
Students should:		
· understand the benefits of proper insulation for energy efficiency – Technical Knowledge and Skills; · know how to prepare wooden frame walls for insulation – Technical Knowledge and Skills; · be able to identify and select the appropriate thermal insulation material for specific applications – Technical Knowledge and Skills; · be proficient in measuring, cutting, and installing wood fiber boards accurately – Technical Knowledge and Skills; · follow safety protocols, including the use of protective gear and safe handling of tools and materials – Safety Awareness; · understand how to prevent hazards during installation – Safety Awareness; · identify common installation errors (e.g., gaps or improper seals) and apply corrective actions effectively – Problem-Solving and Troubleshooting;	· demonstrate punctuality and readiness to participate in the lesson – Responsibility and Reliability; · take responsibility for following safety protocols during practical tasks – Responsibility and Reliability; · work effectively in teams, distributing tasks and supporting one another during group activities – Team Collaboration; · actively contribute to discussions, sharing ideas and solutions – Team Collaboration; · clearly articulate their observations, questions, and feedback during discussions and troubleshooting sessions – Effective Communication; · listen attentively to instructions and the contributions of their peers – Effective Communication; · exhibit patience and creativity when addressing challenges, such as installation errors – Problem-Solving Skills;	· accurately use construction and insulation-related terminology (e.g., "thermal resistance," "airtight sealing," "wood fiber boards") – Technical Vocabulary; · effectively communicate their observations, questions, and ideas during group work and discussions – Verbal Communication; · confidently present their findings or completed tasks (e.g., during material presentations) – Verbal Communication; · actively listen to instructions, teacher demonstrations, and contributions from peers – Listening Skills; · process and follow safety protocols based on verbal explanations – Listening Skills; · communicate clearly and respectfully with teammates during group activities – Collaborative Communication; · provide constructive feedback and accept suggestions from peers during hands-on tasks – Collaborative Communication;

· collaborate in groups during hands-on activities, sharing tasks and responsibilities – Teamwork and Communication; · communicate their observations and suggestions during discussions and troubleshooting – Teamwork and Communication; · recognize the ecological benefits of using sustainable materials like wood fiber boards – Environmental Awareness; · understand the long-term impact of proper insulation on energy consumption and environmental conservation – Environmental Awareness; · assess their work using self-assessment forms and peer feedback – Evaluation and Reflection; · articulate lessons learned and key takeaways from the activity – Evaluation and Reflection.	· seek help or clarification when needed and propose viable solutions to encountered issues – Problem-Solving Skills; · remain open to feedback from teachers and peers to improve their skills – Adaptability and Open-Mindedness; · be willing to adapt their approach based on new insights or suggestions – Adaptability and Open-Mindedness; · appreciate the importance of sustainable practices and recognize the broader impact of their work on the environment – Environmental Awareness.	· complete evaluation forms, self-assessments, or written descriptions of their work effectively – Written Communication; · understand and use handouts, step-by-step guides, or technical worksheets provided during the lesson – Written Communication; · articulate potential solutions to troubleshooting scenarios clearly and logically – Problem-Solving Communication; · justify their reasoning when identifying and addressing common installation errors – Problem-Solving Communication; · adapt their language to suit the context, using more technical terms during tasks and simpler explanations in group discussions or presentations – Adaptability in Language Use.
Prior knowledge · knowledge of the concept of thermal insulation and its role in improving energy efficiency and reducing heating/cooling costs; · ability to use measuring tools, cutting devices, and fasteners safely and accurately; · understanding the basic structure of wooden frame walls and how they are assembled; · awareness of safety protocols for handling insulation materials and construction tools; · familiarity with the ecological benefits of using sustainable materials such as wood fiber boards; · ability to work collaboratively in groups and effectively communicate during practical tasks.	**Assessment** · team work; · completing a checklist evaluating students' performance and understanding of installation techniques; · providing constructive feedback to peers on teamwork, problem-solving, and communication during group activities; · evaluating the insulation installation completed by students based on technical accuracy, airtight sealing, and material usage; · assessing students' engagement and contributions during troubleshooting and recap activities; · looking for relevant questions, solutions offered, and active involvement in group discussions.	**Interdisciplinary references** · Environmental Science: Understanding the impact of proper thermal insulation on energy efficiency and reduced carbon footprint; exploring the sustainability of wood fiber boards and other eco-friendly materials. · Physics: Studying heat transfer principles (conduction, convection, radiation) and how insulation materials minimize heat loss; examining thermal resistance (R-value) and its role in insulation efficiency. · Mathematics: Measuring wall dimensions accurately for insulation installation; calculating the amount of insulation material required based on surface area. · Engineering and Construction: Learning about the design and structure of wooden frame walls; gaining skills in handling construction tools and materials. · Health and Safety: Applying safety measures to protect against hazards while cutting, measuring, or installing insulation materials; understanding the health benefits of proper indoor thermal comfort and air quality. · Economics: Evaluating cost-effectiveness and long-term savings from energy-efficient insulation techniques. · Communication and Teamwork: Developing skills in collaboration and task-sharing during group activities; practicing effective verbal and written communication during discussions and presentations. · Environmental Ethics Exploring the ethical responsibility of using sustainable materials to reduce environmental impact.
Application in the following professions: · construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works, BUD.12. painting and plastering works, BUD.14. organization and control of construction works and preparation of cost estimates	**Levels:** · **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualification (BUD.01, BUD.12 and BUD.14) after graduating from technical secondary school	

Topic overview

Part 1: Introduction and preparation (45 minutes)

Objective: Understanding of the importance of proper thermal insulation for energy efficiency; learning safety precautions and the tools required for working with wood fiber boards; developing skills to measure, plan, and prepare wooden frame walls for insulation.

9. Introduction and safety precautions (10 minutes)

Welcome the students and provide an overview of the lesson objectives.
Discuss on benefits of thermal insulation.
Provide safety instruction, including the correct use of tools and protective equipment.
Assessment: ask questions to check understanding of safety protocols.

10. Overview of wood fiber boards (15 minutes)

Present the properties and benefits of wood fiber boards as an insulation material.
Assessment: Observe and make a brief Q&A session on material properties.

11. Pre-Installation preparation (10 minutes)

Demonstrate the wall preparation, including measurements..
Practical activity: students work in pairs to measure and mark walls, cut wood fiber boards to fit.
Assessment: teacher feedback during activities; students' ability to take accurate measurements and properly cut materials.

Part 2: Installation and application (45 minutes)

Objective: Gain practical skills by students in installing wood fiber boards on wooden frame walls; learn troubleshooting techniques and avoid common installation errors; recap and review best practices for effective insulation.

6. Hands-on installation (30 minutes)

Step-by-step demonstrate the attaching wood fiber boards to wooden frames using fasteners and sealants.
Students perform installation in groups, ensuring airtight seals and minimal gaps.
Assessment: observation of students' work; assessment based on adherence to guidelines.

7. Troubleshooting and discussion (5 minutes)

Highlight common errors (e.g., improper sealing or uneven placement).
Students suggest solutions and discuss experiences during installation.
Assessment: active participation in discussion; ability to identify and solve installation problems.

8. Recap and evaluation (5 minutes)

Summary of key steps and best practices in installing thermal insulation using wood fiber boards.
Students complete self-assessment forms and peer feedback.
Assessment: Completion of evaluation forms and ability to articulate lessons learned.

Safety of building processes

Safety of building processes

Description Reference value in time: 4 x 45 minutes

Description of the situation: The students are enrolled in a Level 4. Students participating in this course already possess basic knowledge about how a construction site operates. They are familiar with the main stages of building processes and can recognize basic construction tools and materials. They are generally aware that working on a construction site involves certain risks; however, their understanding of health and safety regulations is mostly theoretical and superficial. They have not yet had the opportunity to analyze specific hazards related to various job positions on-site or to learn practical methods for avoiding danger. They are not able to independently assess the level of occupational risk, they are unfamiliar with detailed procedures for responding to emergencies, and their knowledge of personal and collective protective equipment is limited to recognizing these items without understanding their proper use in real working conditions.

Working task: The goal of the course is to prepare students to behave consciously and responsibly on a construction site, in accordance with health and safety standards. By the end of the course, students should understand the real dangers that may occur in construction work and be familiar with the regulations and standards designed to eliminate or minimize those risks. They will be able to identify potentially hazardous situations, respond appropriately to irregularities, and select suitable protective equipment for specific tasks. Students will also learn to interpret safety signs and apply the correct procedures in emergency situations, such as accidents or fires. Through this training, they will gain not only theoretical knowledge but also practical skills, enabling them to begin working safely and responsibly in their profession, in line with current legal and industry requirements.

General implementation guidelines and clarifications

- clearly outline the meaning and objectives of a lesson on construction site safety ;
- encourage active participation through discussion, questions and practical exercises to engage students throughout the lesson;
- use multimedia resources such as presentations and videos to enhance understanding and effectively illustrate key concepts;
- incorporate real-life case studies to provide practical context and stimulate critical thinking among students;
- adapt to different learning styles, using a variety of teaching methods and offering additional support where necessary;
- allocate time for reflection and discussion to allow students to process information, ask questions and share insights;
- use formative assessment strategies to monitor students' progress and provide timely feedback to reinforce key concepts.

Teaching materials

18. PowerPoint presentation:
- slides covering key concepts, introduction to site safety, hazards and risks, safety procedures, case studies, good and bad practice;
- images and diagrams images and diagrams illustrating hazards and risks, safety procedures and case study examples.

19. Videos:
- demonstration videos showing construction site accidents, safety procedures;
- videos showing case studies of construction site safety.

20. Handouts and worksheets:
- handouts summarising key points covered in the lesson.

21. Additional resources:
- Textbooks or online resources providing further reading on site safety;
- websites, articles or research papers discussing best practice in construction site safety.

Professional competence	Personal and social competence	Language and communication competences
Students should:		
· gain a comprehensive knowledge of site safety, including hazards and risks, site safety procedures, examples and good and bad practice, which is essential for a career in architecture, engineering, construction or building management - Technical knowledge; · developing problem-solving skills by analysing complex construction scenarios and proposing effective construction safety solutions - Problem-solving skills; · gaining practical experience in countering hazards and minimising risks on site - Technical application.	· demonstrate self-management skills by actively participating in activities, managing their time effectively and seeking feedback to improve their understanding of site safety - Self-management; · collaborate with peers during group discussions, practical activities and case study analysis, developing teamwork skills and the ability to work effectively in different groups - Collaboration; · consider the ethical implications of planning for safe working conditions on site, including the impact on the health and safety of occupants, promoting responsible decision-making in the design and construction of buildings - Ethical Responsibility.	· expand their technical vocabulary related to construction site safety, including terminology such as the Health and Safety Plan, increasing their ability to communicate effectively in a professional context - Technical Vocabulary; · develop their comprehension reading skills by analysing technical documents, case studies and industry standards related to construction safety, enabling them to extract relevant information and apply it to practical scenarios - Reading with Understanding; · practice written communication skills by summarizing key concepts, documenting their findings from case study analysis, and presenting their insights in written reports or presentations, demonstrating clarity and coherence in their writing – Written Communication; · demonstrate active listening skills by engaging carefully in class discussions, asking questions and seeking clarification on complex concepts related to construction site safety - Active Listening;

		· Developing verbal communication skills by expressing an understanding of site safety, providing case study analysis and explaining the rationale for proposed solutions, demonstrating clarity, consistency and confidence in communication - Verbal Expression; · improving presentation skills by delivering concise and engaging presentations on construction site safety, incorporating visual aids, structuring content effectively and adapting communication style to the audience, supporting effective communication in a professional environment - Presentation Skills.
Prior knowledge · basics of building construction; · basic knowledge of safe and hygienic working conditions.	**Assessment** · team work; · the knowledge test; · worksheets for students.	**Interdisciplinary references** · Law: Students become familiar with occupational health and safety regulations, the labor code, and the responsibilities of both employers and employees. They learn to understand the legal consequences of safety violations. · Psychology: Topics include the impact of stress, fatigue, and group pressure on behavior. Students develop awareness of human factors that contribute to mistakes and accidents. · Physics: Basic physical principles such as force, balance, overload, and machinery operation are discussed to help understand the risks associated with construction work. · Biology: Students explore bodily responses to injuries, the basics of first aid, and how to act in emergency situations involving health and safety threats. · IT and New Technologies: Digital tools such as VR simulations, safety applications, and online learning platforms are used to support learning and develop technological competencies. · Ethics and Sociology: Emphasis is placed on the responsibility for the safety of others, the importance of teamwork, and the role of ethical values in workplace culture. · Management: Students learn the fundamentals of work planning, task organization, and risk forecasting to support safe and efficient operations on the construction site.
Application in the following professions: · construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works, BUD.12. painting and plastering works, BUD.14. organization and control of construction works and preparation of cost estimates	**Levels:** · **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualification (BUD.01, BUD.12 and BUD.14) after graduating from technical secondary school	

Topic overview

Part 1: Introduction to Construction Site Safety (45 minutes)

Objective: Students understand the importance of safety on a construction site, can identify common hazards, and are familiar with the basic types of personal protective equipment (PPE).

1. Introduction (5 minutes)

Discuss what construction safety means and why it is essential.
Present examples of what can happen when safety rules are ignored: injuries, work stoppages, legal responsibility.
Brief statistics – number of accidents in the construction sector.

2. Personal Protective Equipment (20 minutes)

   Introduce basic PPE used on construction sites: hard hat, safety boots, gloves, protective goggles, hearing protection, high-visibility clothing, safety harness.
   Explain the purpose of each item and when it should be used.
   Use real examples (if possible) or images to illustrate.
   Short task: students match each type of PPE to the hazard it helps prevent.

3. Behavior and safety (15 minutes)

   Discuss how everyday habits affect safety: avoiding haste, staying focused, following rules, reporting problems.
   Provide examples of unsafe behaviors and their potential consequences.

4. Summary (5 minutes)

   Students complete the sentence: “The most important thing I learned today is…”
   The teacher emphasizes: safety is a combination of knowledge, awareness, and responsible actions – supported by the proper use of protective equipment.

   Students formulate one sentence to summarize what they’ve learned.
   The teacher emphasizes: safety is not just about rules – it’s a mindset and everyday responsibility.

Part 2: Accident and Health Hazards on Construction Sites (45 minutes)

Objective: Students are able to identify the most common accident-related and health-related hazards on construction sites and understand their impact on both individual workers and the entire team.

1. Introduction (5 minutes)

   Opening question: “What can happen on a construction site that puts someone's health or life at risk?”
   Short explanation: Hazards include not only accidents but also long-term health risks.

2. Accident-related hazards (15 minutes)

   Discussion of the most frequent types of accidents: falls from height, slips and trips, being struck by objects, being crushed, contact with machinery.
   Illustrated with photos or short incident descriptions.
   Simple case analysis: what was the cause and how could it have been prevented?

3. Health hazards (15 minutes)

   Presentation of less visible threats: noise, dust, vibrations, extreme temperatures, stress.
   Discussion on the long-term effects on the body – e.g. respiratory issues, hearing loss, back problems.
   Short exercise: students match hazards with possible health outcomes.

4. Why is it important to know about these hazards? (5 minutes)

   Summary: being aware of hazards helps prevent them.
   Encouragement to stay alert and take action when noticing potentially dangerous conditions.

5. Summary (5 minutes)

   Students answer orally: “Which hazard surprised you the most and why?”
   Teacher emphasizes: both visible and invisible risks are equally serious – it's essential to recognize them and understand their consequences.

Part 3: Safe Working Conditions on the Construction Site – Procedures, IBWR, Construction Logbook (45 minutes)

Objective: Students understand the importance of documentation in organizing safe work on a construction site, with a focus on IBWR (Safe Work Method Statement) and the construction logbook.

1. Introduction (5 minutes)

   Opening discussion: “Is knowing the risks enough to stay safe on a construction site?”
   Explain that safety comes not only from behavior but also from following procedures and keeping proper documentation.
2. What is an IBWR? (15 minutes)

   Short explanation: IBWR is a document that describes how to carry out a specific task safely.
   Present the main elements: scope of work, identified hazards, preventive measures, and responsible persons.
   Show a sample IBWR excerpt – students identify listed hazards and proposed safety measures.
3. The role of the construction logbook (20 minutes)

   Explain that the construction logbook is an official document recording the progress of work, changes, comments, and incidents.
   Who writes in it and what is recorded? Show simple examples: start of work, weather delays, inspector's remarks.
   Emphasize that the logbook has legal value and helps confirm compliance with safety and technical standards.
4. Summary (5 minutes)

   Ask students:
   – “Why is the IBWR important?”
   – “How does the logbook help workers?”
   Students write down one sentence they remember from the lesson.
   The teacher reinforces the message: documentation is not just paperwork – it’s real protection for people’s health and safety.

Part 4: Moving Safely on the Construction Site – Good and Bad Practices (45 minutes)

Objective: Students learn key rules for moving safely around a construction site and can identify proper and improper behavior.

1. Basic rules (15 minutes)

   Discuss essential rules: following marked paths, avoiding restricted zones, being aware of surroundings, making eye contact with machine operators, responding to signs and signals.
   Students write down the rule they believe is most important.
   Give examples of unsafe behavior (e.g. walking while using a phone, entering active work areas without permission).

2. Analysis of good and bad practices (15 minutes)

   Show images or short scenes depicting construction site situations.
   Students assess: what was done correctly, what was risky?
   In pairs, they create a short list of 3 good practices that improve movement safety on-site.

3. Evaluation (15 minutes)

   Assessment of individual test.
   Conduct the knowledge test.

Thermal insulation materials

Thermal insulation materials	
Description	Reference value in time: 2 x 45 minutes
Description of the situation: The students are enrolled in a Level 4 EQF course on building construction. They have a basic understanding of thermal concepts but need to delve deeper into the selection, application, and significance of thermal insulation materials in building design and construction. **Working task:** The task for this lesson is for students to gain a comprehensive understanding of thermal insulation materials, including their types, properties, application techniques, and selection criteria. Students will engage in hands-on activities and case studies to reinforce their learning and apply their knowledge to real-world scenarios.	
General implementation guidelines and clarifications	
· clearly outline the importance and objectives of the lesson on thermal insulation materials in building construction and energy efficiency; · encourage active participation through discussions, questions, and hands-on activities to engage students throughout the lesson; · use multimedia resources like presentations and videos to enhance understanding and illustrate key concepts effectively; · provide opportunities for students to examine physical samples of insulation materials and practice installation techniques; · incorporate real-world case studies to provide practical context and stimulate critical thinking among students; · cater to diverse learning styles by employing various instructional methods and offering additional support as needed; · allocate time for reflection and discussion to allow students to process information, ask questions, and share insights; · use formative assessment strategies to monitor student progress and provide timely feedback to reinforce key concepts.	
Teaching materials	
22. PowerPoint presentation: · slides covering key concepts, including heat transfer mechanisms, types of insulation materials, properties, advantages, and limitations; · images and diagrams illustrating insulation materials, installation techniques, and case study examples; · graphs or charts displaying thermal conductivity, R-value, and U-value comparisons between different insulation materials. 23. Samples of insulation materials: · physical samples of various insulation materials, such as fiberglass batts, foam boards, cellulose, mineral wool, and reflective insulation; · allow students to touch and examine the texture, density, and other physical properties of each material; 24. Videos: · demonstrative videos showing installation techniques for different types of insulation materials, including batts, rolls, loose-fill, and rigid boards; · case study videos showcasing buildings with effective thermal insulation solutions and the installation process; 25. Case studies and practical examples: · printed or digital case studies of buildings with successful insulation solutions, including descriptions of the building's design, insulation materials used, challenges faced, and outcomes achieved; · practical examples of insulation applications in various building components, such as walls, roofs, and floors, with accompanying analysis and discussion questions; 26. Handouts and worksheets: · handouts summarizing key points covered in the lesson, including definitions of thermal terms, properties of insulation materials, and installation techniques; · worksheets or guided questions for students to complete during class activities, such as analyzing case studies, comparing insulation materials; 27. Additional resources: · textbooks or online resources providing further reading on thermal insulation materials, building codes and standards, energy efficiency, and sustainable construction practices; · websites, articles, or research papers discussing advancements in insulation technology, emerging materials, and best practices in insulation design and installation.	

Professional competence	**Personal and social competence**	**Language and communication competences**
Students should:		
· acquire a comprehensive understanding of thermal insulation materials, including their types, properties, application techniques, and significance in building construction, which is essential for careers in architecture, engineering, construction, or building management - Technical Knowledge; · develop problem-solving skills by analyzing complex building scenarios and proposing effective insulation solutions to meet energy efficiency and thermal comfort requirements - Problem-Solving Skills; · gain hands-on experience with insulation materials and installation techniques, preparing them for future roles where they may be required to select, specify, or oversee the installation of insulation materials in building projects - Technical Application.	· demonstrate self-management skills by actively participating in class activities, managing their time effectively, and seeking feedback to improve their understanding of thermal insulation materials – Self-Management; · collaborate with peers during group discussions, hands-on activities, and case study analysis, fostering teamwork skills and the ability to work effectively in diverse groups – Collaboration; · consider ethical implications related to the selection and use of insulation materials, including environmental impact, energy efficiency, and occupant health and safety, promoting responsible decision-making in building design and construction - Ethical Responsibility.	· expand their technical vocabulary related to thermal insulation materials, including terminology such as conduction, convection, R-value, U-value, and moisture management, enhancing their ability to communicate effectively in professional contexts – Technical Vocabulary; · develop reading comprehension skills by analyzing technical documents, case studies, and industry standards related to thermal insulation materials, enabling them to extract relevant information and apply it to practical scenarios – Reading Comprehension; · practice written communication skills by summarizing key concepts, documenting their findings from case study analysis, and presenting their insights in written reports or presentations, demonstrating clarity and coherence in their writing – Written Communication;

		· demonstrate active listening skills by engaging attentively in class discussions, asking questions, and seeking clarification on complex concepts related to thermal insulation materials – Active Listening; · develop verbal expression skills by articulating their understanding of insulation concepts, presenting their analysis of case studies, and explaining their reasoning behind proposed insulation solutions, demonstrating clarity, coherence, and confidence in their communication – Verbal Expression; · hone presentation skills by delivering concise and engaging presentations on thermal insulation materials, incorporating visual aids, structuring their content effectively, and adapting their communication style to their audience, fostering effective communication in professional settings – Presentation Skills.
Prior knowledge · basics of building construction; · ; · basic knowledge of the physical properties of construction materials; · basic knowledge of heat-related terms.	**Assessment** · team work; · the knowledge test; · worksheets for students.	**Interdisciplinary references** · Materials Science: Studying different materials used for insulation, like fiberglass and foam plastics. · Thermodynamics: Understanding how heat moves and how insulation slows it down. · Architecture: Using insulation in buildings to save energy and keep people comfortable. · Environmental Impact: Looking at how insulation affects the environment during production and disposal. · Chemistry: Examining the chemical makeup of insulation materials. · Physics: Understanding heat flow and resistance in insulation. · Engineering: Applying insulation in construction and infrastructure projects. · Energy Efficiency: Using insulation to make buildings and processes more energy-efficient. · Sustainability: Finding eco-friendly insulation options. · Manufacturing: Making insulation materials and ensuring quality.
Application in the following professions: · construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works, BUD.12. painting and plastering works, BUD.14. organization and control of construction works and preparation of cost estimates	**Levels:** · **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualification (BUD.01, BUD.12 and BUD.14) after graduating from technical secondary school	

Topic overview

Part 1: Introduction to thermal insulation materials (45 minutes)

Objective: Introduce students to the concept of thermal insulation materials and their importance in building construction.

12. Introduction (5 minutes)

    Welcome the students and provide an overview of the lesson objectives.
    Explain the significance of thermal insulation materials in maintaining thermal comfort and energy efficiency in buildings.

13. Basics of heat transfer (10 minutes)

    Review the fundamental principles of heat transfer: conduction, convection, and radiation.
    Discuss how thermal insulation materials work to reduce heat transfer through these mechanisms.
    Introduce metrics used to evaluate the thermal performance of insulation materials, such as R-value, U-value, and thermal conductivity.

14. Types of thermal insulation materials (20 minutes)

Present various types of insulation materials, including fiberglass, foam boards, cellulose, mineral wool, and reflective insulation.
Describe the properties, advantages, and limitations of each type of insulation material.

15. Factors influencing insulation selection (10 minutes)

Discuss factors that influence the selection of insulation materials, including climate, building design, cost, and environmental considerations.
Emphasize the importance of choosing insulation materials that meet building code requirements and sustainability goals.
Provide materials for students to touch and examine different types of insulation products.

Part 2: Application and selection of thermal insulation materials (45 minutes)

Objective: Familiarize students with the practical application and selection criteria of thermal insulation materials.

9. Environmental considerations (10 minutes)

Present the need of sustainability of insulation materials.
Highlight of recyclability and environmental impact.
Introduce the emerging trends in eco-friendly insulation.

10. Case studies and practical examples (20 minutes)

Present case studies of buildings that have successfully implemented thermal insulation solutions.
Analyze the challenges faced and lessons learned from these projects, including the role of insulation materials in achieving energy efficiency and occupant comfort.

11. Conclusion and summary (5 minutes)

Summarize the key concepts covered in the lesson.
Encourage students to apply their knowledge of thermal insulation materials in real-world scenarios.
Invite questions and provide additional resources for further exploration.

12. Evaluation (10 minutes)

Assessment of individual statements.
Conduct the knowledge test.

Usage of healthy materials in buildings

Usage of healthy materials in buildings

Description Reference value in time: 4 x 45 minutes

Description of the situation: The students are enrolled in a Level 4 EQF course on building construction. They have a basic knowledge of common building materials but need to delve deeper into the understanding of the importance of healthy materials in construction and comprehending the role of material choices in environmental and health sustainability.

Working task: The task for this lesson is for students to identify and list a range of eco-friendly and non-toxic materials commonly used in modern construction, explaining their health benefits. They will analyze case studies where the use of healthy materials has improved indoor air quality and occupant well-being. The task concludes with reporting on how the selection of healthy materials can contribute to sustainable building certification systems, such as LEED or BREEAM.

General implementation guidelines and clarifications

- begin with an introduction to the concept of healthy materials, including a definition and examples (e.g., low-VOC paints, recycled wood, natural insulation);
- highlight the impact of these materials on health (e.g., improved indoor air quality, reduced allergic reactions, and enhanced comfort);
- discuss industry standards like LEED, WELL, and BREEAM that emphasize healthy material usage and compliance;
- present case studies that showcase real-world examples of buildings where healthy materials have been used effectively, linking the materials to the overall health of the building's occupants;
- have students engage in material comparison exercises, where they analyze the pros and cons of conventional vs. healthy materials in terms of cost, durability, and environmental impact;
- focus on building technician-relevant aspects like material selection during procurement, ensuring compliance with health and safety regulations, and managing costs while meeting environmental goals;
- provide resources or tools to evaluate material certifications, such as labels or documentation that signify a material's health benefits or environmental impact;
- allocate time for reflection and discussion to allow students to process information, ask questions, and share insights.

Teaching materials

28. PowerPoint presentation:
- slides covering key concepts of healthy materials, their benefits, and relevant standards like LEED, WELL, and BREEAM;

29. Video demonstrations:
- clips showing the installation and usage of sustainable and non-toxic materials in construction projects;

30. Material samples:
- physical samples of healthy building materials (e.g. thermal insulation) for hands-on examination;

31. Certification guidelines:
- printed or digital materials outlining criteria for material certification systems (e.g., GreenGuard, FSC for wood, etc.);

32. Technical datasheets:
- Examples of manufacturer-provided documents detailing the chemical composition and health impact of various building materials;

33. Case studies and examples
- examples of successful strategies for using healthy materials and their outcomes;

34. Handouts and worksheets:
- summary handouts of key concepts and strategies;
- worksheets or guided questions for students to complete during class activities, such as analyzing case studies, identifying and mitigating thermal bridges.

Professional competences	**Personal and social competences**	**Language and communication competences**
Students should:		
· be able to identify, evaluate, and select healthy, eco-friendly materials for construction projects based on their health impacts, environmental benefits, and sustainability certifications – Material Selection Competence; · understand industry standards such as LEED, BREEAM, and WELL, and how to apply these frameworks in selecting and recommending materials that meet healthy building criteria – Knowledge of Standards and Certifications; · be aware of the health implications of various building materials, including reducing exposure to harmful substances like volatile organic compounds (VOCs) and formaldehyde, and promoting indoor air quality – Health and Safety Awareness; · be competent in integrating healthy material choices into broader sustainability practices in construction, contributing to greener, more sustainable building projects – Sustainability Integration; · be capable to troubleshoot and find practical solutions to integrate healthy materials within project requirements, ensuring compliance with health and environmental guidelines – Problem-Solving in Material Use.	· have the sense of personal responsibility for selecting and promoting materials that are not only safe for building occupants but also environmentally sustainable – Environmental Responsibility; · have the ability to make ethically sound choices regarding material selection, prioritizing the health and well-being of occupants, workers, and the community over short-term financial gains – Ethical Decision-Making; · improve the ability to critically evaluate materials and assess their long-term impacts on health, safety, and the environment, leading to informed and responsible decision-making – Critical Thinking and Problem Solving; · develop an eye for detail in assessing materials for certifications, health impact labels, and environmental credentials to ensure compliance with sustainability and safety standards – Attention to Detail; · deepen awareness of the social impact of building material choices, including the effects on public health, community well-being, and worker safety – Social Responsibility and Impact Awareness;	· be familiarize with the specialized terminology related to healthy building materials, including terms like VOCs (volatile organic compounds), LEED certification, sustainable materials, non-toxic, and indoor air quality – Technical Vocabulary; · be able to read, interpret, and accurately explain material datasheets, certifications, and labels (e.g., GreenGuard, FSC, etc.) to ensure proper understanding of material properties and health impacts – Material Specifications; · be able to write clear, concise, and accurate reports, specifications, and recommendations related to the use of healthy materials in building projects – Clear and Concise Writing; · enhance communication skills to collaborate effectively within multidisciplinary teams (architects, engineers, designers) to discuss and integrate healthy materials into the overall design and construction process – Collaborative Communication; · improve confidence in delivering presentations or leading discussions on the topic of healthy materials, helping to promote sustainability and safety practices to a wider audience – Presentation and Public Speaking.

	· become a proactive advocate for the adoption of healthy, sustainable materials within construction teams and projects, promoting a culture of health, safety, and sustainability in the built environment – Advocacy for Sustainability; · enhance collaboration skills – Team Collaboration.	
Prior knowledge · basics of building construction; · basic knowledge of the physical properties of construction materials; · basic knowledge of sustainable building practices; · basic knowledge of common building materials and their impact; · basic knowledge of indoor environmental quality (IEQ); · basic knowledge of life-cycle assessment (LCA); · basic knowledge of eco-friendly material selection; · basic knowledge of how carbon footprints affect building materials · basic mathematical skills.	**Assessment** · team work; · the knowledge test; · worksheets for students.	**Interdisciplinary references** · Environmental Science: Understanding how the selection of healthy materials impacts ecosystems, resource conservation, and waste reduction. Exploring how healthy materials contribute to combating climate change by reducing emissions and improving energy efficiency in buildings. · Chemistry: Learning about the chemical properties of building materials (e.g., VOCs, formaldehyde) and their effects on human health and indoor air quality. · Health Sciences: Studying the connection between building materials and occupant health, including respiratory conditions, allergies, and sick building syndrome. Exploring how healthy materials can improve the comfort and health of occupants, addressing thermal, acoustic, and visual comfort through appropriate material selection. · Economics: Studying the growing demand for green buildings and how healthy materials play a key role in aligning with market trends and consumer preferences. · Architecture and Design: Understanding how healthy materials contribute to biophilic design principles that aim to create spaces that connect people to nature, improving mental and physical health. Exploring how the aesthetics of natural and healthy materials (e.g., bamboo, cork, reclaimed wood) enhance both the design and function of modern buildings. · Regulatory and Legal Studies: Examining how local, national, and international building codes, standards, and certifications (like LEED, WELL, BREEAM) enforce the use of healthy materials and promote sustainable practices in the construction industry. · Sociology and Urban Studies: Understanding how the use of healthy materials contributes to the broader social goal of creating healthier, more sustainable urban environments, benefiting public health and promoting equity in housing. · Engineering (Mechanical and Civil): Investigating how healthy materials contribute to building performance in terms of energy efficiency, insulation, and structural integrity. Understanding how the integration of healthy materials influences the engineering aspects of sustainable construction, including material sourcing, transportation, and installation.
Application in the following professions: · construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works, BUD.12. painting and plastering works, BUD.14. organization and control of construction works and preparation of cost estimates	**Levels:** · **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualification (BUD.01, BUD.12 and BUD.14) after graduating from technical secondary school	

Topic overview

Part 1: Introduction to healthy building materials (45 minutes)

Objective: Set the context for the lesson and introduce the key topics, define and clarify the concept of healthy building materials, explain their importance, and identify the common materials used in sustainable construction.

Introduction (20 minutes)

Welcome the students and provide an overview of the lesson objectives.
Define and characterize healthy materials (e.g., non-toxic, low-emission, eco-friendly).
Explain the importance of using healthy materials (impact on human health, indoor air quality, and sustainability).

Types of healthy materials (20 minutes)

Present the various healthy building materials and their properties.

Summary and questions (5 minutes)

Wrap up the discussion and answer students' questions.

Part 2: Health and environmental impact of building materials (45 minutes)

Objective: Familiarize students with the health and environmental impacts of different building materials.

Health impacts (15 minutes)

Discuss how building materials can impact indoor air quality and human health (e.g., VOCs, allergens).

Environmental impacts (15 minutes)

Overview of environmental issues related to building materials (e.g., carbon footprint, resource depletion, recyclability).

Case study analysis (10 minutes)

Overview of environmental issues related to building materials (e.g., carbon footprint, resource depletion, recyclability).

Q&A and summary (5 minutes)

Wrap up the discussion and answer students' questions.

Part 3: Principles of material selection and regulatory framework (45 minutes)

Objective: Learn the principles and criteria for selecting healthy building materials. Understand the regulatory framework for healthy materials in construction.

1. Principles of material selection (20 minutes)

   Introduce the criteria for selecting healthy materials (e.g., life-cycle assessment, durability, certifications).

2. Regulatory framework (20 minutes)

   Overview of standards and regulations related to healthy materials (e.g., LEED, WELL Building Standard).

3. Summary and Discussion (5 minutes)

   Wrap up and review key concepts.

Part 4: Building tour, evaluation, and worksheet activity (45 minutes)

Objective: Apply the knowledge of healthy materials by identifying them in a real building environment. Evaluate the use of healthy materials through observation and guided analysis.

1. Introduction to building tour and worksheet (5 minutes)

   Brief introduction to the building tour, explaining how to evaluate the materials used in the building and fill in the worksheet.

2. Building tour and material evaluation (25 minutes)

   Guided tour of the building, focusing on identifying and evaluating the materials used in construction. Students will work in pairs or small groups to observe and document examples of healthy and unhealthy materials.

3. Worksheet completion and group discussion (5 minutes)

   Students complete the worksheet based on their observations during the tour.
   Group discussion on the findings, sharing insights and observations.

4. Evaluation test (5 minutes)

   Students complete the evaluation test.

Thermal bridges

Thermal bridges		
Description		Reference value in time: 2 x 45 minutes
Description of the situation: The students are enrolled in a Level 4 EQF course on building construction. They have a basic understanding of thermal concepts but need to delve deeper into the understanding of heat transfer, recognizing the weak places in buildings in terms of heat conductivity, and preventing and eliminating thermal bridges in buildings. **Working task:** The task for this lesson is for students to study the principles of thermal conduction and learn to identify common locations where thermal bridges occur in building structures. They will analyze how these bridges affect energy efficiency and propose methods to minimize their impact using different construction techniques and materials. The task concludes with case studies and mitigation strategies to reinforce their learning and apply their knowledge to real-world scenarios.		
General implementation guidelines and clarifications		
· clearly state the learning objectives, emphasizing the importance of understanding thermal bridges and their impact on energy efficiency in construction; · use diagrams and thermal images to visually demonstrate where thermal bridges commonly occur and how they affect heat flow in buildings; · include a brief review of the thermal conductivity of common construction materials, highlighting those prone to creating thermal bridges; · provide case studies or examples from real-world building projects that show the consequences of poor thermal bridge management; · discuss various theoretical mitigation techniques, such as the use of thermal breaks, enhanced insulation strategies, and improved construction details at junctions; · encourage students to engage in discussions about the challenges of identifying and mitigating thermal bridges in different building designs; · conclude with a summary of key concepts, followed by a task where students write a brief explanation of how they would apply these principles in a hypothetical construction scenario; · allocate time for reflection and discussion to allow students to process information, ask questions, and share insights.		
Teaching materials		
35. PowerPoint presentation: · slides covering key concepts of thermal bridges, effects of thermal bridges on energy efficiency, and overview of mitigation strategies; 36. Visual aids: · diagrams showing common thermal bridge locations in building structures; · cross-sectional illustrations of building elements highlighting potential thermal bridges; 37. Thermal imaging samples: · real-world thermal images displaying heat loss due to thermal bridges; · comparative images showing before-and-after scenarios with mitigation techniques applied; 38. Material property charts: · thermal conductivity charts for various construction materials; · tables comparing materials commonly used in areas prone to thermal bridging; 39. Case Studies and examples: · written or video case studies on building projects with identified thermal bridges; · examples of successful mitigation strategies and their outcomes; 40. Handouts and worksheets: · summary handouts of key concepts and strategies; · worksheets or guided questions for students to complete during class activities, such as analyzing case studies, identifying and mitigating thermal bridges.		
Professional competences	**Personal and social competences**	**Language and communication competences**
Students should:		
· be able to recognize and pinpoint areas in building designs where thermal bridges are likely to occur. This includes understanding common locations such as wall-to-floor junctions, window and door frames, roof intersections, and areas where different materials meet. They should be able to analyze architectural plans and construction details to identify these weak points and understand the potential impact on the building's thermal performance – Thermal Bridge Identification; · be capable of developing and recommending effective strategies to mitigate thermal bridges in construction projects. This involves understanding various construction techniques, such as the use of thermal breaks, enhanced insulation methods, and proper detailing of building junctions. They should also be able to consider the practical aspects of implementation, such as cost, material availability, and the impact on construction timelines, ensuring that the proposed solutions are both effective and feasible – Mitigation Strategy Development; · gain the ability to select appropriate materials that minimize the risk of thermal bridging. This includes understanding the thermal properties of different construction materials,	· should enhance their problem-solving abilities by thinking critically about how to address thermal bridging issues. This includes evaluating different mitigation strategies, considering the pros and cons of various approaches, and making decisions that balance technical requirements with practical considerations – Problem-Solving Skills; · develop the ability to collaborate effectively with peers, instructors, and professionals in the field. They should be able to communicate their findings and recommendations clearly, both in written and verbal formats, and work together with others to refine ideas and solutions for mitigating thermal bridges in construction projects – Collaboration and Communication; · cultivate a strong attention to detail, enabling them to carefully examine building plans and construction details to identify potential thermal bridges. This competence is essential for ensuring accuracy in their work and avoiding oversights that could lead to energy inefficiency in buildings – Attention to Detail.	· be able to accurately use and understand key technical terms related to thermal bridges, such as "thermal conductivity," "thermal break," "junction," and "insulation," in both written and spoken communication – Technical Vocabulary Proficiency; · be able to explain complex concepts related to thermal bridges and their impact on energy efficiency in a clear and concise manner, making the information accessible to both technical and non-technical audiences – Clear and Concise Explanation; · develop the ability to write structured, well-organized reports or summaries that detail their analysis of thermal bridges, proposed mitigation strategies, and the rationale behind their recommendations – Report Writing Skills; · enhance their ability to present their findings and recommendations to an audience, using visual aids such as diagrams and thermal images to support their explanations and ensure clarity – Presentation Skills; · practice asking relevant, insightful questions during discussions and be able to provide constructive feedback to peers, contributing to a collaborative learning environment – Effective Questioning and Feedback;

such as thermal conductivity, and how these properties influence the overall energy efficiency of a building. They should be able to conduct a basic analysis of material choices, comparing their thermal performance and cost implications, and make informed decisions that contribute to the long-term sustainability and efficiency of the building project – Material Selection and Analysis.		· improve their active listening skills, ensuring they can accurately interpret and respond to questions, critiques, and suggestions from instructors and peers during discussions or collaborative work – Active Listening.
Prior knowledge · basics of building construction; · basic knowledge of the physical properties of construction materials; · basic understanding of heat transfer; · basic knowledge of heat-related terms; · reading construction plans; · basic mathematical skills.	**Assessment** · team work; · the knowledge test; · worksheets for students.	**Interdisciplinary references** · Building Physics: Understanding how heat moves through materials, including conduction, convection, and radiation, and how these principles apply to identifying and addressing thermal bridges. · Energy Efficiency and Sustainability: Understanding how thermal bridges contribute to heat loss and affect the overall energy efficiency of buildings. · Environmental Science: Understanding the role of thermal bridge management in reducing a building's carbon footprint and contributing to environmentally friendly construction practices. · Thermal Dynamics and Heat Transfer: Knowing the basic concepts of thermal conductivity and thermal resistance, which are essential for understanding how thermal bridges impact heat flow in building envelopes. · Architecture: Understanding how architectural detailing can prevent or mitigate thermal bridges through effective junction design and material selection. · Building Regulations and Standards: Knowing the building codes and standards that address thermal performance requirements and regulations for managing thermal bridges to ensure compliance and improve building energy efficiency. · Construction Technology: Information on construction materials and techniques that can influence or reduce the risk of thermal bridging, including advanced insulation materials and construction methods.
Application in the following professions: · construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works, BUD.12. painting and plastering works, BUD.14. organization and control of construction works and preparation of cost estimates	**Levels:** · **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualification (BUD.01, BUD.12 and BUD.14) after graduating from technical secondary school	

Topic overview

Part 1: Introduction to thermal bridges (45 minutes)

Objective: Introduce students to the thermal bridging phenomenon, including the impact of thermal bridges on energy efficiency, building comfort, and potential structural issues, supported by visual examples and case studies.

16. Introduction (5 minutes)

Welcome the students and provide an overview of the lesson objectives.
Explain of what thermal bridges are in the context of construction and energy efficiency.

17. Basics of heat transfer (10 minutes)

Review the fundamental principles of heat transfer: conduction, convection, and radiation.
Discuss the role of thermal conductivity in heat transfer.
Explain the significance of cold bridges.

18. Types and characteristics of cold bridges (20 minutes)

Explain how to distinguish types of cold bridges (geometric, material, linear, point, etc.).
Specify basic characteristics that make certain structures prone to thermal bridging.

19. Impact on energy efficiency (10 minutes)

Introduce the basics of energy efficiency in buildings.
Explain how cold bridges affect heating and cooling costs.

20. Recognizing cold bridges in buildings (10 minutes)

Point out the common areas prone to cold bridges.
Explain how to recognize visual signs of potential issues.
Explain how to interpret the thermal imaging surveys.

Part 2: Recognizing and mitigating thermal bridges in buildings (45 minutes)

Objective: Familiarize students with effective strategies to recognize and mitigate thermal bridges in building designs as well as the material selection, construction techniques, and design considerations that minimize thermal bridging, and apply this knowledge to analyze and improve a provided building plan.

13. Recognizing thermal bridges in buildings – practical part (20 minutes)

Provide the students architectural plans and let them identify thermal bridges in small groups.
Let the students indicate ways to avoid and eliminate thermal bridges. .

14. Conclusion and summary (5 minutes)

Consolidate and recap of key concepts.
Address students' queries and concerns.

15. Evaluation (25 minutes)

Let the students present their conclusions.
Assess individual statements.
Provide and check the knowledge test.

Environmental protection – Sustainable construction / Green buildings

LS 10:	Environmental protection - Sustainable construction /Green buildings
Description of the Learning Scenario (LS):	**Time limit: 90 minutes**

Description of the situation: The apprentices are undergoing vocational training in the construction industry in the areas of building construction, civil engineering or finishing. They already have a basic knowledge of building materials and construction materials in building construction, civil engineering or finishing. In this learning unit, learners are familiarised with the principles of sustainable construction. They should take a closer look at the topics of environmental protection, sustainable construction and green building

Work task:

The task for the learning unit is to deal with the basics of sustainable building, to learn what sustainable building means, what influence it has on a healthy environment and a healthy life in society.

General Implementation guidelines and clarifications

- use in the basic training of the construction professions in the areas of building construction, civil engineering and finishing at level 4 and in foreman and master craftsman training at level 6
- it starts with a brief introduction and definition of what a green building/sustainable building is and the objectives of the EU's Green Building Programme
- the three pillars of sustainable buildings are considered and their weighting discussed
- presentation of the contents of the guidelines for sustainable buildings in Germany
- participants are given a short overview of certification systems for sustainable buildings
- learners are familiarised with the 3 life phases of a building and deal with the topics of life time, carbon footprint and material pass of building materials and construction materials
- the learning unit is concluded with case studies (in short videos)
- learners are actively involved in a topic-related discussion throughout the entire learning unit

Teaching materials

- Interactive white board
- Digital devices (tablets, laptop, PC)
- Power Point presentations
- Videos
- Case studies/examples
- Handouts and worksheets

Professional competences	**Language and communication competences**
The learners …	

• know the definition of a sustainable / green building • know the EU Programme - Green Building • have knowledge of the 3 pillars of sustainable building • can explain the life cycle of a building with its 3 life phases from the project idea to disposal • have knowledge of the contents of the guidelines for sustainable building • have knowledge of sustainable building materials and construction materials • know online databases for determining material characteristics	• are familiar with the technical terminology of sustainable building • are able to read material data sheets • can communicate with those involved within the group • can record information on special construction features • can use technical terms correctly

Previous knowledge	**Assessment**	**interdisciplinary notes**
▪ fundamentals of building construction ▪ Basic knowledge of building physics ▪ Basic knowledge of common building materials and their effects ▪ Specialist knowledge of environmental protection and the impact of building materials ▪ Basic knowledge of the effects of the carbon footprint ▪ Have literacy skills,	▪ Team work ▪ Knowledge test	

Evaluation

- In a short knowledge test (digital), the participants are asked 10 closed questions on the basics of sustainable building
- This is followed by a digital evaluation of the LU via forms

Topic overview

1. Introduction to the topic - green buildings (10 minutes)

Objective: The learners are familiarised with the topic of green buildings.

The following content is taught:

- query what they understand by this and what expectations they have of the learning unit
- define what a green building is and explain the objectives of the EU Green Building Programme.

2. Sustainable building (20 minutes)

Objective: The learners have knowledge of what a sustainable building is. They know the 3 pillars of sustainable building and are informed about the contents of the Guideline for Sustainable Building.

- define what a sustainable building is.
- explain the 3 pillars of sustainable building (ecological/economic/social).
- short introduce the Guideline for Sustainable Building
- name the main points of the guideline.
- name 3 existing certificates worldwide
- explain the quality seal in your country (in Germany - that of the DGNB)

3. Environmental protection - influence of building materials (30 minutes)

   Objective: The learners are familiar with the 3 life phases (categorisation in the life cycle) of a building. They have knowledge about the influence of the life cycle and the carbon footprint of building materials on the environment.

   - explain the life cycle of buildings to the participants
   - explain the 3 life phases of sustainable buildings from the project idea to the disposal of a building.
   - explain the term service life of building materials and components.
   - show the participants how they can obtain the relevant values from online databases.

   - give some examples
   - explain what the carbon footprint is and which material passports for building materials already exist in your country…

4. Practical examples (20 minutes)

Objective: The learners know practical examples from short videos.

Show selected details of buildings that can be categorised as sustainable buildings and comply with the applicable standards and recommendations. In short multimedia tours of a selected building, show the learners various building details such as

- Wall insulation made from sheep's wool
- Photovoltaic system, solar panel
- Use of building materials produced in the neighbourhood (short delivery routes)
- Use of renewable raw materials (wood, sheep's wool, etc.)
- Biological sewage treatment plant
- Rainwater collection systems
- Green roof (extensive)
- etc.

Explain your choice and discuss it with the participants.

5. Evaluation (10 minutes)

Objective: Knowledge test of learners in 10 digital questions and evaluation (digital)