

Didactic and methodological notes for:

Module 3 - Reducing the energy consumption of a residential building with a smart home system

Goal of the module

Objective:

The trainees should be able to create a detailed consultation concept for the implementation of a smart home system to save energy, depending on the customer's apartment or house.

Introduction scenario:

The owner of an apartment or small house has heard that it is possible to save energy by using smart home components in their home. They contact an electrician or heating engineer with the following request:

“I would like to optimize my home's energy consumption and have heard that this is possible by installing smart home components.

Specifically, I have the following questions:

1. What is the potential to save energy with the help of smart home, and how big is it?
2. Can you give me a recommendation where a smart home system makes the most sense and where the cost/benefit ratio is most favorable?
3. Can you tell me how complex the installation of a Smart Home system is and what kind of work I will have to do?
4. Please make a suggestion of a suitable manufacturer and compile a list of all the components I need for my home.

Please send me a written consultation.”

Target groups and levels:

Trainees in the following professions

- Electrical engineering
- SHK plant mechanic

- IoT
- All at EQF level 4

Competence profile related to the VQTS-Matrix			
Competence areas	Competence development steps	Level	Interdisciplinary / cross-disciplinary competences
5: Conception of building systems, their components and the associated processes	He/she can dimension and select components of building systems according to the concepts created from the user profiles in compliance with regulations and guidelines.	4	The trainees of the related trades can: • create a work plan with the required work steps • identify the possibilities of reducing energy by using a smart home system. • select the necessary components • explain the function of the components to the customer
8: Communication across trades, also in foreign languages	He/she can read product data sheets and carry out assembly and operating instructions of his/her own and other trades.	3	The trainees can work together as a group of Electricians, Heating- and Cooling experts and IoT-specialists to solve the task of

			reducing energy by using a smart home system. The trainees can: • read and interpret statistical data on the energy consumption of residential buildings
	He/she can understand and use technical terms from his/her own and other trades.	4	The trainees can: • read data sheets of smart home components and evaluate the components described there regarding their suitability for reducing the energy consumption of residential buildings.
10: Digital information and knowledge management	He/she can choose basic and advanced digital tools to solve professional tasks and use them in a targeted, collaborative manner not only in his/her own profession. He/she can select and use suitable digital tools to create technical presentations and documentation.	4	The trainees can: • prepare a documentation on the possibilities of energy saving through smart home for the specified residential building in a collaborative way using appropriate digital tools.

Competence profile related to the matrix for sustainable thinking and acting	
Sustainable Development Fields in VET	Competence development steps
Energy conservation: competence related to the identification and application of practices to reduce energy consumption, with the aim of reducing environmental impact and associated costs.	He/She applies energy conservation strategies in his/her working environment, analysing consumption and proposing improvements. The trainees can analyse and interpret the statistics on the breakdown of energy consumption in residential buildings by type of energy and identify the largest energy consumers.
Energy efficiency practices: involves the knowledge and application of techniques to reduce energy consumption, promoting practices that optimise efficiency and reduce waste.	He/She identifies opportunities to improve energy efficiency in projects and implements them in his/her work. To reduce heating requirements, the trainees develop a concept for optimizing the existing heating system by using smart home components
Country	Where can the module be implemented in your national curriculum?

Germany	Plant mechanic for sanitary, heating and air conditioning systems Possible docking: • Learning field 12, Installing resource-saving heat generation systems (third year) • Learning field 14, Adjusting supply systems and optimizing energy efficiency (fourth year) • Overall matrix: Possible links between learning fields and work and business processes: Field of activity 2, customer-oriented advice and information, planning Electronics technician for energy and building technology Possible docking: • Overall matrix: Possible links between learning fields and work and business processes: Field of activity 2, customer-oriented advice and information, planning • Learning field 10, Automation technology systems install, commission and handover (third year) • Learning field 11, Automation technology systems maintain, document and optimize (third year)
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Italy	1. Technical Institute for Technological Sector – Electrotechnics and Electronics Path Docking: • Fourth and Fifth Year • Relevant Learning Units: ○ Electrical and Electronic Systems ○ Technologies and Design of Electrical and Electronic Systems ○ Automation Description: The module can be introduced as a curriculum extension to provide skills in designing, installing, and managing IoT systems for smart buildings. Students will learn how to configure devices for energy control (lighting, heating, air conditioning) and use integrated management platforms for energy savings. 2. Vocational Education and Training (IeFP) – Electrical Technician (Fourth Year) Docking: • Electrical Technician Path – Fourth Year (Specialization EQF 4) • Relevant Learning Units: ○ Civil and Industrial Electrical Systems
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	○ Technologies for Energy Efficiency ○ Home Automation Systems Description: The module can be integrated as a practical specialization to train technicians capable of installing and configuring IoT devices for smart homes. The focus will be on optimizing energy consumption through sensors, actuators, and cloud platforms for remote monitoring.
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In which way does the module enrich the content of one profession with qualification requirements from previously unrelated areas

Plant mechanic for sanitary, heating and air conditioning systems:

- Internet of Things (IoT) technology to manage interconnected smart home systems

Electronics technician for energy and building technology:

- Operation and functionality of different heating systems and the respective control options
- Internet of Things (IoT) technology to manage interconnected smart home systems

IoT-Specialists:

- Operation and functionality of different heating systems and the respective control options

All:

- Possibilities of the reduction of the energy consumption of a residential building
- Professionals learn how to educate clients about energy savings, ROI (Return on Investment) of smart systems, and the environmental benefits, transitioning from technical roles to advisory capacities.

Training plan			
Preliminary remarks on the working form	The learning situation should be worked on in groups. If possible, trainees from different trades should work together in the working groups, e.g. electronics technicians for energy and building services engineering and HVAC plant mechanics		
Title of the lessons / individual units	Competences	Duration / volume in training hours	Comments
Introduction into the scenario Creating a working plan and presentation of the results	The ability to solve problems systematically	2 h	The trainees draw up a list of the information they need to complete the task and derive a work plan from it Documents: • <i>01a-Scenario task.docx</i> • <i>02-residential building customer.docx</i> Alternatively, guiding questions can be used as an introduction. Documents: • <i>01b-Scenario key questions.docx</i>

energy consumption of a residential building	The ability to interpret statistical data in a goal-oriented manner.	2 h	The trainees interpret statistics on the breakdown of energy consumption in residential buildings by type of energy (heat, lighting, etc.), discuss the results and decide where most energy can be saved. Internet-Recherche or using given statistics Documents: • <i>03-Energy-consumption-residential-buildings-Germany.docx</i>
Types of heating systems	Trainees can name the basic components of a heating system and describe their function. Trainees can understand and describe the function of and differences between the various types of	2 – 4 h	Trainees are given an overview of the basic function of a heating system and how the different types of heating and heat distribution systems work. The amount of time required depends on the depth to which the topic is covered. the trainees use the technical information provided Documents:

	heating and heat distribution systems.		• <i>04a-Information Heating systems.docx</i> • <i>04b-tasks-Heatingsystems-blanc.docx</i> Sample solution Task sheet 4: • <i>04b-sample-solution-tasks-Heatingsystems-blanc.docx</i>
Proposal for reducing the heat requirement of the specified residential building with the help of smart home	Trainees interpret the technical data of smart home system components. Trainees select all components required for heating control and describe their basic functionality The trainees justify their choice with regard to the goal of saving energy	4h	The trainees gain an overview of the possibilities of heating control using smart home components The trainees analyse the heating system of the specified residential building and develop a concept for a smart home system for heating control with the aim of saving energy. The trainees use technical information provided by smart home companies on the Internet. Documents: • <i>05-Smart-Home-systems.docx</i> • <i>06-Blanc-Consultation-Concept.docx</i>

			Sample solution • <i>06-Sample-consulting-concept.docx</i>
Presentation and competence assesment	The working groups explain their results.	2h	Presentation Assessment by using an online tool, e.g. Kahoot! (Presentation of several short questions, the trainees answer by smartphone)
Optional:			
Further possibilities of saving energy in a residential building by using a smart home system		2 h	• Time-dependent heating control • Time-dependent lighting control and / or via presence detectors • -Control of roller shutters and awnings

Description of the tasks for competence assessment

Assessment:

Evaluation of the concept developed to reduce the heat demand. This can be done, for example, by the working groups evaluating each other's concepts.

A further competence check can be carried out by:

- Online with a quiz tool (self-evaluation)
- Online multiple-choice test
- Conventional paper-based multiple-choice test
- Partial task as part of a class assignment

Possible questions for a multiple choice test:

- *07-question-assessment.docx*

Sample solution:

- *07-sample-question-assessment.docx*

Evaluation of the modul:

- *08-question-evaluation.docx*