

Didactic and methodological notes for:

Submodule 2: Problem solving on a solar thermal system

Goal of Submodule 2
<p>Objective:</p> <p>In this submodule, the effects of too frequent stagnation (corrosive heat transfer medium = water-glycol mixture) in a solar thermal system are discussed using the example of a fixed solar pump. From this problem, the students derive possible measures for the customer to avoid stagnation.</p> <p>Introduction scenario:</p> <p>In the meantime, the solar thermal system has been fully installed, tested for function and put into operation. After one year, you carry out maintenance on the solar thermal system. You realise that the solar pump is malfunctioning (see message below!). When removing the pump, you notice that the pump is stuck and that the solar fluid has changed considerably. The pH value of the solar fluid has dropped to pH=4.</p> <p>When asked, the customer describes the operation of the system since commissioning:</p> <ul style="list-style-type: none"> - The first summer was very warm with many hours of sunshine. On many summer days, there was more solar heat available than the customer could use. The system therefore often switched off even though the sun was shining. - The following winter, there were very few hours of sunshine, so the system was not in operation over the winter months. <p>Your job is to describe to the customer in writing how the poor condition of the system could have come about. You also give the customer a list of tips on how to minimise these problems in the future.</p> <p>Target groups EQF level 3-4:</p> <p>Students</p> <p>mechanic</p>

Competence profile related to the VQTS-Matrix			
Competence areas	Competence development steps	Level	Interdisciplinary / cross-disciplinary competences
Maintain building systems or their components	<ul style="list-style-type: none"> ✓ He/She can operate components of building systems according to the specifications and check their function. ✓ He/she can carry out inspection, maintenance 	EQF 3-4	<ul style="list-style-type: none"> ✓ The student can link the effects of corrosion in the solar circuit with different operating states of the solar thermal system. ✓ The students can give the customer recommendations

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	and repair work on components of building systems in accordance with the manufacturer's instructions [...].		on user behaviour that improve the operating behaviour of the solar thermal system and avoid/reduce stagnation
Communication across trades, also in foreign languages	<ul style="list-style-type: none"> ✓ He/she can understand basic technical terms of his/her own and other professions. ✓ He/she can hold discussions with superiors and employees of his/her own and other trades as well as with customers in an appropriate manner and present and explain facts. 	EQF 3-4	<ul style="list-style-type: none"> ✓ Students can formulate suitable measures for the customer (layperson) using technical terms. ✓ The students can give self-confident feedback.

Competence profile related to the matrix for sustainable thinking and acting	
Competence area	Competence development steps
Energy saving: Expertise in identifying and applying practices to reduce energy consumption, with the aim of reducing environmental impact and associated costs.	✓ He/she identifies basic measures to reduce energy consumption in specific activities.
Environmental compliance: Enables him/her to know, apply and ensure compliance with the rules and regulations related to environmental protection in his/her work activities.	✓ He/she understands and follows basic environmental regulations that apply to his/her daily activities.
Material Saving Instructions: Follows and applies instructions aimed at reducing the unnecessary use of materials to promote the responsible and efficient use of available resources.	✓ He/she optimises the use of materials through specific instructions and adapts working practices to minimise consumption.
Hazardous waste disposal: Enables the identification, classification and safe handling of hazardous waste in compliance with established regulations and to minimise health and environmental hazards.	✓ He/she identifies and classifies hazardous waste and follows handling procedures under supervision.

Interdisciplinary collaboration: working efficiently in multidisciplinary teams, working with professionals from different fields to achieve common goals in terms of sustainability and environmental improvement.	<ul style="list-style-type: none"> ✓ He/she works with others on basic tasks and understands the importance of working together to achieve sustainable goals. ✓ He/she coordinates and works in multidisciplinary teams.
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Country	Where can the module be implemented in your national curriculum?
Germany	Vocational training for learning field 9 (installation of drinking water heating systems)
Finland	A unit based on local competences. The training provider defines the requirements for vocational competence and the assessment of competence in a similar way to the vocational units.
Spain	Heat-generating systems, installation and maintenance of solar energy systems.

In which way does the module enrich the content of one profession with qualification requirements from previously unrelated areas			
<ul style="list-style-type: none"> ✓ Students understand the functional relationships between user behaviour and the operating states of the solar thermal system in order to derive suitable behavioral recommendations for the customer. ✓ Learners can assess the consequences of stagnation on the individual components of the solar thermal system. ✓ Learners communicate effectively with trainees from other professions. 			
Training plan Submodule 2			
Title of the lessons / individual	Competences	Duration / volume in training hours	Comments
Introduction and introduction to the learning situation		90 mins	Agreement on the scope and quality of the product to be created.
Information phase	✓ The students know the consequences of strong solar radiation on the solar collector without sufficient		The learners examine the information material and use it to acquire the knowledge

	<p>utilisation or storage of the solar heat.</p> <ul style="list-style-type: none"> ✓ Students can assess the effects of various weather influences on the overall system. 		<p>required to assess the effects of stagnation on the overall system.</p>
Product creation	<ul style="list-style-type: none"> ✓ The students summarise the previously learned content in a short description for the customer. ✓ The students link the effects of the weather and solar radiation on the heat transfer medium of the solar thermal system and derive sensible recommendations for action for the customer. 	60 mins	<ul style="list-style-type: none"> ✓ In the written summary, common technical terms are used for the customer and formulated in a way that the customer can understand. ✓ The students' work should show a connection between the unused solar heat, the poor condition of the system and user behaviour.
Presentation	<ul style="list-style-type: none"> ✓ The students can evaluate the product quality of the other groups and make constructive suggestions for improvement and further solutions. 	30 mins	<ul style="list-style-type: none"> ✓ The products are presented in plenary. The non-presenting groups evaluate the presented checklist and give constructive feedback.
Valuation			<ul style="list-style-type: none"> ✓ The products are evaluated by the teacher with regard to the technical correctness and usefulness of the proposed changes in user behaviour for the customer.
Reflection / Evaluation	<ul style="list-style-type: none"> ✓ The students apply their new knowledge to create a joint checklist with the whole class. 	90 mins	<ul style="list-style-type: none"> ✓ The students check their newly acquired specialist knowledge when drawing up the joint checklist. ✓ The last uncertainties are discussed and the last gaps in knowledge are closed.

Description of the tasks for competence assessment

The assessment of competence growth can take the form of a written examination or be assessed by evaluating the written products. This can also be done in combination with the main module and sub-modules 1 and 2 of this series of lessons on solar thermal energy.