

1 Key CVET data

1. Name:	<p>Suggestions:</p> <ol style="list-style-type: none"> 1. Building: Energy efficiency in an integrated system 2. Building work execution as an integrated system 3. Successful completion of energy-efficiency building projects 4. Craftsmen skilled in energy efficiency construction
2. CVET level/DQR level	4 (CVET qualification)
3. Target group	Journeymen in the construction, finishing and HVAC trades
4. Duration:	88 IU (instructional units) (+ exam module)
5. Admission requirements:	Journeyman status

The goal of improving collaboration between different trades (hereinafter referred to as inter-trade collaboration) on a building site is promoted through allowing journeymen to participate in this CVET course aimed at furthering an understanding of a house as an integrated system. Such an understanding highlights the needs for the different trades to work with each other in those areas where they interface with each other. The course develops participants’ practical skills in the field of energy-efficient construction and refurbishment, highlighting the need to improve execution. At the same time, the journeymen gain in-depth theoretical knowledge.

The CVET programme is based on a transfer of practical knowledge. Through the use of concrete situations and examples, participants become qualified to execute, communicate and document energy efficiency measures on new and existing buildings, taking into account interfaces to other trades in an overall understanding of a “building as an integrated system”.

Participants thus become competent on-site partners in the field of energy-efficient construction and refurbishment.

2 Overview of the modules

01	A building's envelope and HVAC systems as an integrated energy-efficient system			16 IU
	1	Understanding a house as an integrated system	3 IU	
	2	Gaining a basic understanding of the interacting effects of building physics factors	5 IU	
	3	Understanding one's own work as part of an overall construction process	5 IU	
	4	Understanding the interaction between a building's envelope and its HVAC systems and the importance of proper execution	3 IU	
02	Quality assurance with regard to energy efficiency			8 IU
	1	Strengthening an understanding for quality in the execution of construction work	1 IU	
	2	Recognising and assessing faulty workmanship	4 IU	
	3	Documenting the quality of completed construction work	2 IU	
	4	Recognising the importance of communication when collaborating with other trades	1 IU	
03	Energy-efficient construction and refurbishment			16 IU
	1	Understanding the requirements of energy-efficient construction and refurbishment	8 IU	
	2	Comparing various energy-efficiency standards for housing projects and their impact on construction techniques and the choice of materials	8 IU	

04	Ensuring an energy-efficient building envelope: windows/doors, external wall penetrations, services pipework		16 IU
	1	Installing windows/doors and external wall penetrations, together with the associated HVAC systems	8 IU
	2	Installing energy-efficient penetrations for services pipework	8 IU
05	Ensuring the energy efficiency of lofts: technical systems, roof windows and roof exits		16 IU
	1	Installing photovoltaic and solar heating systems on and in energy-efficient roofs	8 IU
	2	Installing technical systems on and in energy-efficient roofs	4 IU
	3	Installing roof windows and exits (including the associated HVAC systems) in energy-efficient roofs	4 IU
06	Ensuring energy efficiency when finishing a building: inside insulation, ceilings, lofts		16 IU
	1	Using inside insulation as an alternative to outside insulation	8 IU
	2	Efficiently insulating ceilings	4 IU
	3	Energy-efficient loft conversions	4 IU
			88 IU
+	Exam module as a prerequisite for gaining certification		

Module 01: A building’s envelope and HVAC systems as an integrated energy-efficient system

Module duration: 16 instructional units¹ (2 days)

Theme		Competences		Contents
1	Understanding a house as an integrated system [Duration: 3 IU]	1	Indicating the relationships between a house’s components	<ul style="list-style-type: none"> A building envelope and HVAC systems Weak points (Erroneous) user behaviour: Dampness through use, persons, drying washing, plants, animals The effects of (erroneous) user behaviour on insulated buildings
		2	Indicating the technical interfaces of a fully integrated house and naming the trades involved	<ul style="list-style-type: none"> Windows-outside walls HVAC systems Interface roof/walls HVAC systems: ducting, wall penetrations (...)

¹ The module has been initially designed for 16 IUs. On completion of a pilot course, this may be increased to 20 IUs.

Theme		Competences		Contents
2	Gaining a basic understanding of the interacting effects of building physics factors [Duration: 5 IU]	1	Illustrating the effects of damp-proofing on a building's structure and systems	<ul style="list-style-type: none"> ▪ Forms of damp (damp in new buildings, condensation) ▪ Water transport in building components ▪ Effects of excessive dampness ▪ Statutory requirements ▪ Manufacturer information
		2	Explaining the effects of thermal insulation on a building's structure and systems	<ul style="list-style-type: none"> ▪ Forms of heat transfer ▪ Parameters ▪ Heat loss of/through building components ▪ Understanding the effects of excessive damp on heat transfer ▪ Knowing the U-values of typical building components and taking account of them when selecting materials ▪ Statutory requirements, manufacturer information ▪ Winter and summer thermal protection
		3	Knowing the (different) applications of insulation techniques and taking account of them during execution	<ul style="list-style-type: none"> ▪ Inside and core insulation ▪ Exterior wall insulation: Exterior insulation and finish system (EIFS) ▪ Loft insulation: Above-, between- or under-rafter insulation ▪ Perimeter insulation ▪ Different insulation materials, properties, advantages/disadvantages ▪ The insulation of critical building components

Theme		Competences		Contents
3	Understanding one's own work as part of an overall construction process [Duration: 5 IU]	1	Describing the interfaces between participating trades when constructing/refurbishing a building	<ul style="list-style-type: none"> Describing interfaces between construction and finishing trades / HVAC and electrical trades Interface between a building's envelope and HVAC systems Interface between construction/finishing work and electrical installations Interface between HVAC systems and electrical installations
		2	Indicating the direct points of contact with other trades when executing one's own work	<ul style="list-style-type: none"> Taking account of <ul style="list-style-type: none"> HVAC electrical considerations when executing construction/finishing work
		3	Describing the work phases of upstream trades and the necessary prerequisites for one's own work	
		4	Stating the requirements needing to be fulfilled for downstream trades to complete their work successfully	<ul style="list-style-type: none"> Electrical installations: window shutters, exterior wall penetrations HVAC systems
4	Understanding the interaction between a building's envelope and its HVAC systems and the importance of proper execution [General overview] [Duration: 3 IU]	1	Understanding a building's airtightness and the resultant requirements for one's own work	<ul style="list-style-type: none"> Basic principles Statutory airtightness requirements Typical air leakages (causes, avoidance) Tools for checking airtightness (blower-door test) Infrared views
		2	Knowing typical thermal bridges in buildings and taking account of them in one's own work	<ul style="list-style-type: none"> Typical thermal bridges in buildings Infrared views
		3	Recognising the need to adjust the size and setting of the central heating system when making changes to the building's envelope	<ul style="list-style-type: none"> Benefits and necessity of hydraulic balancing Benefits and requirements in the selection/tuning of central heating systems

Module 02: Quality assurance with regard to energy efficiency

Module duration: 8 instructional units (1 day)

Theme		Competences		Contents
1	Strengthening an understanding for quality in the execution of construction work [Duration: 1 IU]	1	Understanding the importance of quality for the successful operation of a building	<ul style="list-style-type: none"> Economic consequences Customer loyalty Order intake
		2	Understanding the influence of quality on sustainability	<ul style="list-style-type: none"> Sustainable materials Eco-sustainable materials
		3	Indicating the relationship between quality and customer satisfaction	<ul style="list-style-type: none"> Dealing with customers Teamwork Keeping a building site clean / tidying up at the end of one's work
2	Recognising and assessing faulty workmanship [Duration: 4 IU]	1	Recognising selected faulty workmanship situations [selection dependent on participants' trades]	<ul style="list-style-type: none"> Recognising execution errors/material defects on the basis of selected faulty workmanship situations Explaining the cause of faulty workmanship situations using the knowledge gained in Module 01 Typical instances of faulty workmanship
		2	Describing the causes of selected faulty workmanship situations and their consequences for an energy-efficient building	
3	Documenting the quality of completed construction work [Duration: 2 IU]	1	Defining criteria for assessing quality	<ul style="list-style-type: none"> Checklists Construction diaries
		2	Assessing the quality of executed construction work in one's own trade	<ul style="list-style-type: none"> Criteria for checking executed construction work in one's own trade
		3	Documenting the quality of executed construction work on the basis of the materials used	<ul style="list-style-type: none"> Documenting work during all construction phases
4	Recognising the importance of different trades communicating with each other [Duration: 1 IU]	1	Supporting the coordination of the different trades	<ul style="list-style-type: none"> Interaction between building trades (communication and coordination mechanisms) Scheduling
		2	Assessing schedules with regard to one's own work	

Module 03: Energy-efficient construction and refurbishment

Module duration: 16 instructional units (2 days)

Theme		Competences		Contents
1	Understanding the requirements of energy-efficient construction and refurbishment [Duration: 8 IU]	1	Understanding climate protection and sustainability as a societal task and challenge	<ul style="list-style-type: none"> Defining the meaning of “sustainability” Climate protection, resource conservation, energy affordability, non-fossil energy production Basic eco-construction principles “Grey energy”
		2	Understanding the structure and functioning of energy-efficient buildings and distinguishing them from conventionally constructed buildings	<ul style="list-style-type: none"> Requirements for energy-efficient buildings Passive house construction Winter and summer thermal protection Energy-efficient HVAC systems The interaction between thermal protection and HVAC systems in energy-efficient buildings Energy efficiency building parameters Effects of different insulation materials, layering sequences and insulation thickness on building components Heating systems Renewables Energy distribution The special case of older buildings
		3	Understanding the importance of damp-proofing, thermal protection and insulation techniques in energy-efficient construction/refurbishment	<ul style="list-style-type: none"> Thermal protection/insulation parameters Statutory requirements Manufacturer information
		4	Understanding airtightness requirements in energy-efficient buildings and their execution consequences	<ul style="list-style-type: none"> Typical air leakages (causes, avoidance) Checking airtightness
		5	Knowing weak points in an energy-efficient building envelope and taking account of them during execution	<ul style="list-style-type: none"> Damp-proofing and thermal protection Insulating critical building components and connections

Theme		Competences		Contents
2	Comparing various energy-efficiency standards for housing projects and assessing their impact on construction techniques and the choice of materials [Duration: 8 IU]	1	Differentiating between existing energy efficiency standards and distinguishing their separate energy-efficiency parameters	<ul style="list-style-type: none"> ▪ EnEV (the German Energy Efficiency Regulation) ▪ KfW energy-efficient houses ▪ Passive houses ▪ Ultra-low energy houses ▪ Other possible standards (e.g. the EU directive on the energy performance of buildings, regional regulations)
		3	Demonstrating the effects of energy efficiency standards on construction methods and the choice of materials	
		4	Explaining the effects of energy efficiency standards on construction methods and the choice of materials when refurbishing a building	<ul style="list-style-type: none"> ▪ Heat transfer loss and primary energy requirement in the EnEV, in KfW energy-efficient houses, passive and ultra-low energy houses ▪ U-values for walls, windows and doors under the EnEV, overall view ▪ Heat transfer loss and primary energy requirement dependent of the year of construction ▪ When does the EnEV apply (replacement, size of building components) ▪ Special cases and exceptions

Module 04: Ensuring an energy-efficient building envelope: windows/doors, external wall penetrations, services pipework

Module duration: 16 instructional units (2 days)

Theme		Competences	Contents	
1	Installing windows/doors and external wall penetrations, together with the associated HVAC systems [Duration: 8 IU]	1	Describing the execution requirements for an energy-efficient building envelope	<ul style="list-style-type: none"> Airtightness and damp-proofing Thermal bridges Insulation materials (choice, interaction, use) The proper installation of windows and doors (special considerations for exterior/interior insulation)
		2	Describing execution requirements with regard to possible HVAC systems	Requirements for: <ul style="list-style-type: none"> Electrically operated window shutters Security technology Wall penetrations for pipework Noise insulation and fire protection Sealing wall penetrations
		3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> Inter-trade communication Dealing with coordination errors and conflicts
		4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> Trades involved Process interlinkage Transport and logistics requirements Installation and anchoring techniques
		5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> Quality criteria and assurance Dealing with coordination errors and conflicts
		6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> Project plan Construction schedule Dealing with coordination conflicts
		7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> Documentation requirements, in particular with respect to the EnEV
2	The energy-efficient installation of services pipework	1	Describing requirements for the proper construction of an energy-efficient building envelope	<ul style="list-style-type: none"> Connections for non-standard features, such as balconies, canopies, a winter garden, solar and photovoltaic systems, ventilation systems Prefabricated wall elements The wall/roof interface

Theme		Competences	Contents
[Duration: 8 IU]			<ul style="list-style-type: none"> ▪ Foundation interfaces ▪ Airtightness and damp-proofing ▪ Thermal bridges ▪ Insulation materials
	2	Describing requirements for the proper installation of HVAC systems	<ul style="list-style-type: none"> ▪ Pipework penetrations ▪ Requirements for noise insulation and fire protection
	3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> ▪ Inter-trade communication ▪ Dealing with coordination errors and conflicts
	4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> ▪ Trades involved ▪ Process interlinkage ▪ Transport and logistics requirements ▪ Installation and anchoring techniques
	5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> ▪ Quality criteria and assurance ▪ Dealing with coordination errors and conflicts
	6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> ▪ Project plan ▪ Construction schedule ▪ Dealing with coordination conflicts
	7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> ▪ Documentation requirements, in particular with respect to the EnEV

Module 05: Ensuring the energy efficiency of lofts: technical systems, roof windows and roof exits

Module duration: 16 instructional units (2 days)

Theme		Competences	Contents	
1	Installing photovoltaic and solar heating systems on and in energy-efficient roofs [Duration: 8 IU]	1	Describing requirements for the proper execution of an energy-efficient roof	<ul style="list-style-type: none"> Special features of flat and sloping roofs Structural analysis and wind loads Special requirements associated with inside insulation Anchoring techniques Airtightness and damp-proofing Thermal bridges Insulation materials
		2	Describing requirements for the proper installation of HVAC systems	<ul style="list-style-type: none"> Pipework penetrations and their sealing Requirements for noise insulation and fire protection Sealing wall penetrations
		3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> Inter-trade communication Dealing with coordination errors and conflicts
		4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> Trades involved Process interlinkage Transport and logistics requirements Installation and anchoring techniques
		5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> Quality criteria and assurance Dealing with coordination errors and conflicts
		6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> Project plan Construction schedule Dealing with coordination conflicts
		7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> Documentation requirements, in particular with respect to the EnEV
2	Installing technical systems on and in energy-efficient roofs [Duration: 4 IU]	1	Describing requirements for the proper execution of energy-efficient roofs	<ul style="list-style-type: none"> Antennas, heat pumps, air conditioning systems, etc. Special features of flat and sloping roofs Anchoring techniques Airtightness and damp-proofing Thermal bridges Insulation materials
		2	Describing requirements for the proper installation of	<ul style="list-style-type: none"> Pipework penetrations and their sealing Requirements for noise insulation and fire protection

Theme		Competences	Contents
		HVAC systems	
	3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> ▪ Inter-trade communication ▪ Dealing with coordination errors and conflicts
	4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> ▪ Trades involved ▪ Process interlinkage ▪ Transport and logistics requirements ▪ Installation and anchoring techniques
	5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> ▪ Quality criteria and assurance ▪ Dealing with coordination errors and conflicts
	6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> ▪ Project plan ▪ Construction schedule ▪ Dealing with coordination conflicts
	7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> ▪ Documentation requirements, in particular with respect to the EnEV

Theme		Competences		Contents
3	Installing roof windows and exits (including any associated HVAC systems) in energy-efficient roofs [Duration: 4 IU]	1	Describing requirements for the proper execution of energy-efficient roofs	<ul style="list-style-type: none"> Airtightness and damp-proofing Thermal bridges Insulation materials Installation of roof windows (interface between window and roof)
		2	Describing execution requirements with respect to possible HVAC systems	<ul style="list-style-type: none"> Electrically operated window shutters Security technology Pipework penetrations and their sealing Requirements for noise insulation and fire protection
		3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> Inter-trade communication Dealing with coordination errors and conflicts
		4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> Trades involved Process interlinkage Transport and logistics requirements Installation and anchoring techniques
		5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> Quality criteria and assurance Dealing with coordination errors and conflicts
		6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> Project plan Construction schedule Dealing with coordination conflicts
		7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> Documentation requirements, in particular with respect to the EnEV

Module 06: Ensuring energy efficiency when finishing a building: inside insulation, ceilings, lofts

Module duration: 16 instructional units (2 days)

Theme		Competences		Contents
1	Using inside insulation as an alternative to outside insulation [Duration: 8 IU]	1	Describing execution requirements for an energy-efficient envelope	<ul style="list-style-type: none"> Situations: Listed buildings, facades worth preserving, non-standard usage conditions Effectiveness of inside insulation dependent on the constitution of the facade (protection against rain) Effect of the insulation on other parts of the building Interface of the inside insulation with windows/ceilings/floors Airtightness and damp-proofing Thermal bridges Insulation materials and systems
		2	Describing execution requirements with respect to HVAC systems	<ul style="list-style-type: none"> Installations and penetrations in the insulation Requirements for noise insulation and fire protection Possibilities of using wall heating
		3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> Inter-trade communication Dealing with coordination errors and conflicts
		4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> Trades involved Process interlinkage Transport and logistics requirements Installation and anchoring techniques
		5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> Quality criteria and assurance Dealing with coordination errors and conflicts
		6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> Project plan Construction schedule Dealing with coordination conflicts
		7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> Documentation requirements, in particular with respect to the EnEV
2	The efficient insulation of ceilings [Duration: 4 IU]	1	Describing execution requirements for an energy-efficient envelope	<ul style="list-style-type: none"> Top-floor ceilings in new and existing buildings Statutory requirements for top-floor ceilings under the EnEV Cellar ceilings in new and existing buildings Base slab in new and existing buildings

Theme		Competences	Contents
			<ul style="list-style-type: none"> Airtightness and damp-proofing Thermal bridges Insulation materials and systems
	2	Describing execution requirements with respect to HVAC systems	<ul style="list-style-type: none"> Penetrations in the insulation Requirements for noise insulation and fire protection Possibilities for integrating underfloor heating and material requirements
	3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> Inter-trade communication Dealing with coordination errors and conflicts
	4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> Trades involved Process interlinkage Transport and logistics requirements Installation and anchoring techniques
	5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> Quality criteria and assurance Dealing with coordination errors and conflicts
	6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> Project plan Construction schedule Dealing with coordination conflicts
	7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> Documentation requirements, in particular with respect to the EnEV

Theme		Competences		Contents
3	Energy-efficient loft conversions [Duration: 4 IU]	1	Describing execution requirements for an energy-efficient envelope	<ul style="list-style-type: none"> Effectiveness of the insulation dependent on the roof construction Airtightness and damp-proofing Thermal bridges Insulation materials and systems
		2	Describing execution requirements with respect to possible HVAC systems	<ul style="list-style-type: none"> Penetrations in the insulation Requirements for noise insulation and fire protection Possibilities of integrating panel heating
		3	Clarifying and communicating who is responsible for what on a construction site	<ul style="list-style-type: none"> Inter-trade communication Dealing with coordination errors and conflicts
		4	Describing the work steps of the trades involved, establishing the priority of one's own work and the direct points of contact with other trades	<ul style="list-style-type: none"> Trades involved Process interlinkage Transport and logistics requirements Installation and anchoring techniques
		5	Assessing the work of upstream trades and deriving consequences for one's own work	<ul style="list-style-type: none"> Quality criteria and assurance Dealing with coordination errors and conflicts
		6	Recognising execution delays and initiating scheduling adjustments in conjunction with the trades involved	<ul style="list-style-type: none"> Project plan Construction schedule Dealing with coordination conflicts
		7	Documenting the execution of one's own work, taking account of the materials used	<ul style="list-style-type: none"> Documentation requirements, in particular with respect to the EnEV

Module 07: Practice-related exam module

Module duration: min. 32 instructional units (4 days)

To gain certification after completing the course, an exam has to be passed². The seventh module was designed exactly for this purpose. Dependent on the number of its participants, it lasts at least 32 hours.

The exam module covers both autonomous observation and documentation activities during routine work and the presentation and discussion of these activities within the group of participants. Three phases are thus involved

OBSERVATION	Using their newly gained competences, participants observe and discuss their routine work. They recognise situations in which they can make use of their knowledge.
DOCUMENTATION	The participants document their observations and prepare a short presentation informing the other participants of their findings
PRESENTATION AND DISCUSSION	Within this final module, each participant presents his observations related to his routine work (see above) and then discusses these with the other participants and the course lecturer(s).

² Course participation will naturally be certified without taking an exam.

3 People involved in the development of the course (in alphabetical order)

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4 Impressum

Publisher

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Also involved were experts from various skilled craft chambers, associations and training institutions (see Chapter 3). The contents of existing CVET courses were included in the development of this curriculum.

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