SolTec - Curriculum

Installation

Competence Unit / Assignments	Module	Learning Units	hours
Installation - Planning - Safety and Environmental Protection - Execution	1) Analyses of needs and context	**1.1 Relevant criteria for needs analyses, energy consumption and optimization** - Physical principles to the energy term - Energy demand in Europe and special countries - Energy demand in buildings - Energy demand analysis of users, user behaviour - Optimization of energy needs **1.2 Solar potential** - Solar energy and its potential - Composition of the solar radiation, solar spectrum, solar radiation - Irradiation on flat and sloping surfaces - Uses of solar energy: photovoltaic, solar thermal - The PV effect, solar cells, cell types and their electrical properties	**15**
	2) Planning of the PV-concept according to the needs analyses	**2.1 Characteristics of the equipment** - Concept of PV-Systems • Off-grid systems • Grid-connected systems	**60**

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		2.2 Technical elements of the PV system - PV modules and their construction • Modules with crystalline cells and thin-film cells, specific modules - Module installation and connection - Cables and wires, connection technology - Technical solutions for fire protection - Inverters - Components and equipment for installation - Connection with the public grid, • Consumer units, distribution boxes • electricity meter, meter cupboard, net-metering, smart grid - Energy storage • batteries, fuel cells, super caps, other methods - Charge controller, off-grid inverter, backup-inverter - Information and **C**ommunications **T**echnology (ICT) in PV systems • data capture, data logger • system evaluation • Presentation and visualisation - Typical systems for data monitoring and documentation **2.3 Topography** - Local radiation, shading problem - On-site appointment • Site survey, checklists - Shading analysis	

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		• Methods and instruments	
	3) Legal, technical and formal obligations	**3.1. Documentation and legal authorization procedures** - Cooperation with the responsible suburb offices, energy suppliers (electric utilities), other trades, financiers **3.2. Legislation and technical standards for grid connection** - Relevant EU and national laws, regulations and standards, Tariff structures - Subsidies, allowances - Tax issues, insurance systems - Economic and ecological assessment	**15**
	4) Planning of the execution	**4.1 Work stages**: project and process management - Principles of Process and Project Management - Use of Planning Management Software (EU or national example) **4.2 Logistic:** Human and technical resources, materials, tools, regulations deliveries, storage possibilities, market and types of materials supplier - Planning and design of a grid-connected system • Sizing the PV generator, inverter, wiring and power connection • Grounding, lightning protection, surge protection, Electromagnetic Compatibility (EMC) • Mounting systems for roof mounted and ground-mounted plants, anchorage, building integration	**60**

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		• Tracking-Systems • Material and Resource Planning • Collaboration with suppliers and other trades • Critical point control in the mounting - Planning and design off-grid systems • Sizing the PV array, the electrical installation and storage according to the needs • Dimensioning of backup systems - Costing and quoting, Marketing and Promotion - Use of simulation and calculation software	
	5) Safety and Environ-mental Protection	**5.1 Health and Safety Plan** - Health, Safety and Fire-protection (HSF) in the construction of PV systems - Relevant legislation (EU, national) **5.2 Safety measures** - Risk assessment and emergency cases - Safety when working on construction sites - Suitability for working at height - Special security provisions for roof work - The use of scaffolding and lifts - Electrical hazards - Individual work safety equipment - First aid	**15**

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		5.3 Environmental protection - Legislation and measures - Site clearance - Recycling, waste disposal	
	6) Preparation of the Installation	**6.1 Installation plan:** Processes and techniques - Planning the work sequences **6.2 Project plans and technical drawings** - Creation of technical documentation using CAD software **6.3 Materials, tools and equipment** - Example of planning a system with all relevant procedures	**30**
	7) Practical Execution	**7.1 Quality principles, efficiency and functional controls** - Principles of Quality Management - Quality assurance and quality performance in the construction of PV systems - Dealing with measurement, evaluation of test results **7.2 Commission** - Plant commissioning and plant hand-over - Warranty issues	**15**

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		7.3 Communication protocol and monitoring systems - Installation and test of the ITC in the PV system - Setting up a typical system for monitoring data and documentation	
	8) Documentation	**8.1 Operational and maintenance manual** - Principles for creating an operating manual - Hand-over Protocol - Examples of system documentation and operating manual	**15**
		Total hours Installation	**225**

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Maintenance and repair

Competence Unit / Assignments	Module	Learning Units	hours
Maintenance and repair - Maintaining, Inspecting and trouble-shooting - Safety and Environmental Protection - Repairing	1) Planning the Maintenance activity	**1.1 Maintenance needs** - Basics: Dependability, failure, availability - Preventive and corrective maintenance - Fault tree analysis - Technical documentation available on the preparation of maintenance **1.2 Planning and organizing of maintenance work** - Maintenance types: Preventive and corrective Maintenance - Basics for organization and planning of maintenance - Computerized Management Maintenance of Solar PV-Installations (CMMS), objectives and basic functions, general rules for implementation - Personnel and cost planning **1.3 Measurement equipment and working tools** - Mechanical and electrical measurement and test methods - Measuring and test equipment - Maintenance tools and materials, Warehouse organization **1.4 Production and fault reports and increase of performance** - Typical disturbances and failures, fault statistics - Examples of fault reports	**30**

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		- Possibilities of system upgrades (repowering) - Cleaning of the PV system	
	2) Safety and Environ-mental Protection	Refer to “Installation” with special attention to electrical hazards **2.1 Work risks, Electrical hazards** - Hazards, occupational health and safety when working on electrical systems - Work on parts of the system under electrical voltage - Relevant laws and regulations (EU, national) - Examples of typical accidents **2.2 Systems for recycling** - Recycling process of defective components	**10**
	3) Execution of maintenance	**3.1 Diagnostic procedures and results interpretation** - Maintenance checklist - Visual inspection procedures - Check for new shading - Analysis of data from the monitoring system (ITC) and interpret results - Use of modern diagnostic procedures, for example Thermal imaging measurement with an infrared camera **3.2 The maintenance of electrical storages** - Accumulators - Other storages	**15**

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		3.3 Mistakes, faults and corrective measures - Distinction between defective and non-defective components - Tolerances - Handling of the measuring and test equipment	
	4) Planning of repair activities, Execution and Verification	**4.1 Diagnostic of anomalies, error records and troubleshooting procedures** - Capabilities for Identification of faulty components - Fault search algorithms, standardized troubleshooting - Troubleshooting guide for a typical grid-tied system and for an off-grid system **4.2 Techniques and tools for repair** - Repairs to the PV array (generator) - Repairs to the inverter - Repairs to the wiring and cupboards - Repairs to the electrical storage - Repairs to the ITC **4.3 The organisation and execution of the repair process** - Planning of personnel, equipment and material **4.4 Manufacturer warranties and quality standards** - Warranty periods (EU, national) - Quality standards for maintenance and repair (EU, national)	**10**

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	5) Maintenance and Repairing Documentation	**5.1 Forms of documentation and technical reports** - Measurement protocol, Hand-over Protocol - Documentation of the work performance in maintenance and repair **5.2 Documentation procedures and tools** - Examples of system documentation	**10**
		Total hours Maintenance and repair	**75**

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Hours of course

Unit	Hours	Total hours
Installation	225	
Maintenance and repair	75	
Total hours of distance learning		300
Classroom course and practical training	50	
Practical training in a company	50	
Total hours of the course		**400**

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