

## The PVTRIN Training and Certification Scheme

*Training methodology and tools*

Stavroula Tournaki, *Technical University of Crete*

Install+RES and PVTRIN Strategic Workshop, Brussels, 12<sup>th</sup> March 2013



### The Challenge



- ❑ **establish a pool of qualified technicians. competent at installing PV systems according multinational quality standards**
- ❑ **provide the key components for a qualification framework, an appropriate training methodology and a transparent accreditation route**
- ❑ **minimize risks or technical failures during the PV system installation and maintenance**
- ❑ **raise awareness of benefits of quality standards, advancement of skills and employing qualified workforce**

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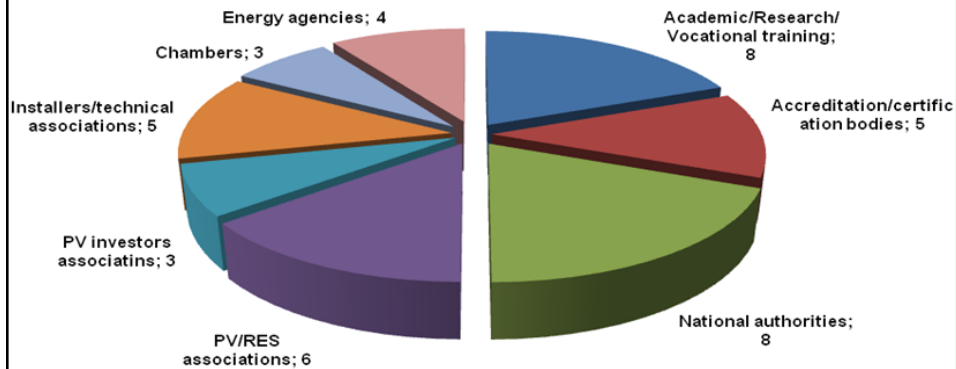


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## National Consultation Committees



**45 organisations of key stakeholders**  
**Contribute to PVTRIN activities, as members of the NCCs** [www.pvtrin.eu](http://www.pvtrin.eu)



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## Market Research – Stakeholders opinion PV investors



### Indicative findings:

- **42%** mentioned **technical failures**
- **35%** consider that the failures are due to malfunctions in electrical installation, technicians inexperience or improper design
- **30%** consider the **technical skills** of the existing PV installers, in relation to their needs, as **non satisfactory**, **42%** **just sufficient**
- **74%** admit that they would be **more confident** if their system was installed by a certified installer; **52%** are willing **to pay more** to have its system installed by certified staff

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## The PVTRIN Training

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### Training methodology

#### Taken into account:

- **Criteria set by RED Directive (Article 14, Annex IV)**
- **National legislative framework**
- **Input and recommendations of the NCC's members, and the identified requirements of the certification scheme**
- **Relevant expertise and successful initiatives in EU**
- **The PV Installers task analysis**

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## PVTRIN Training structure



8 days class course duration 4 weeks	MODULE	CLASS	LAB/SITE	SELF STUDY
	hours			
	1. BASICS	4		6
	2. DESIGN PRINCIPLES	9	3	24
	3. BAPV AND BIPV	4		8
	4. INSTALLATION - SITEWORK	10	2	30
	5. MAINTENANCE AND TROUBLESHOOTING	3	2	8
	6. CASE STUDIES – BEST PRACTICES	3		14
	7. EXAMPLE INSTALLATION OF A SMALL SCALE PV ON BUILDING	4	7	12
	8. QUALITY MANAGEMENT AND CUSTOMER CARE	3		6
		40	14	108

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## The PVTRIN course syllabus



MODULE 4. INSTALLATION - SITEWORK			
Training method (hours):		Class (10), Lab (2), e-learning / self study (30)	
LEARNING UNITS	LEARNING OBJECTIVES Knowledge of....	SKILLS To be able to....	COMPETENCES To be competent at....
4.1. Working safely with PV	safe working practices, potential hazards, safety with electrical installations (DC voltage), security provisions for works at height (roof and façades), safety equipment, fire protection	<ul style="list-style-type: none"> <li>identify and assess any site-specific safety hazards or other issues associated with installation of system</li> <li>maintain safe working practices</li> <li>demonstrate safe and proper use of required tools and equipment</li> <li>demonstrate safe and accepted practices for personnel protection</li> <li>demonstrate awareness of safety hazards and how to avoid them (specific for the electrical installations)</li> <li>identify and implement appropriate codes and standards concerning installation, operation, and maintenance of PV systems and equipment</li> <li>identify and implement appropriate codes and standards concerning worker and public safety</li> </ul>	<ul style="list-style-type: none"> <li>being responsible that the work is carried out according to the safety plans</li> <li>making the working team follow the safety regulations</li> </ul>
4.2. Installation plan	work sequences, technical drawings, technical documentation, tools and equipment, safety plan	<ul style="list-style-type: none"> <li>utilise drawings, schematics, instructions and recommended procedures in installing equipment</li> <li>implement all applicable personnel safety and environmental protection measures</li> <li>visually inspect and quick-test PV modules</li> <li>assemble modules, panels, and support structures as specified by module manufacturer or design/structural engineer.</li> <li>select material, tools, suppliers and other technical resources</li> </ul>	<ul style="list-style-type: none"> <li>taking responsibility for the planning of the involved working team</li> <li>taking decisions concerning the procurement of materials / components and delivery</li> <li>defining the proper working methods</li> <li>being proactive in the required procedures</li> </ul>
4.3. Electrical components installation	mitigate electrical hazards, install grounding system, conduit, electrical components, circuit conductors, system instrumentation, battery components, etc	<ul style="list-style-type: none"> <li>install module array interconnect wiring; implement measures to disable array during installation</li> <li>label, install, and terminate electrical wiring; verify proper connections, voltages, and phase/polarity</li> </ul>	<ul style="list-style-type: none"> <li>being competent at implementing all necessary electrical actions for PV installation</li> </ul>



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## Training approach



- **Classroom Lecturers**
- **Lab practice (Hands-on training)**
- **Trainees' practice and performance assessment during the training**
  - **Theory Assessment**
  - **Practical lab exercises**
  - **Assignments**
- **Self study and practice through the e-learning platform**

**theoretical and practical parts**

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## Trainees' profile



- **qualified electricians**  
**(trained on DC, licensed to practice in electrical installations of at least 10kW)**
- **experience whilst working for an electrical installation company or a PV installation company**

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## Training materials and tools - Trainees





- **PVTRIN Handbook – Study Guide**
- **Checklists – Practical tips**
- **Troubleshooting Guide**
- **E-learning platform**
- **Further resources - Members area**
  - List of common failures and improper practices on PV installations and maintenance
  - Further reading lists (suggested books, online publications etc)
  - Simulation software
  - Useful links

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**PVTRIN Training course**  
Handbook for Solar Installers


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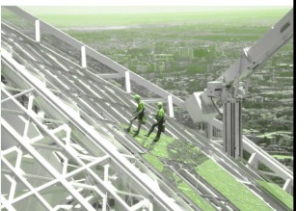


**PVTRIN Training course**  
TROUBLESHOOTING GUIDE


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**PVTRIN Training course**  
WORKSHEETS


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**PVTRIN Training course**  
Checklist & Practical Tips on PV/BIPV installations


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**PVTRIN Training course**  
TRAINERS GUIDE

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## WP3-Development of training material and tools



Technical University of Crete (TUC) Environmental Engineering Department Renewable and Sustainable Energy Systems Lab

## Training materials and tools - Trainers



- **Trainers' Guide**
- **Course Syllabus and Delivery plan**
- **Course Notes**
- **Worksheets (Exercises and Solutions workbook)**
- **E-learning platform – Trainers area**
- **Further resources - Members area**
  - Further reading lists (suggested books, online publications etc)
  - Useful links

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## PVTRIN training – Delivery plan



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WEEK 1 - DAY 1: 6hrs (class: 6hrs/360min)							
	hours / minutes	Learning Unit	Key Learning Points	Delivery method	Training materials / tools	Other resources	Assessment event
MODULE 1. SOLAR BASICS (class: 4hrs/240min, self-study: 6hrs/360min)	Class: 45min (0,75h) Self-Study: 60min (1h)	○ Solar energy	Solar radiation; direct and diffuse radiation; calculations; solar potential	Lecture Online	Handbook Tutors presentations e-learning platform	Computer Projector Internet	NO
	Class: 75min (1,25h) Self-Study: 60min (1h)	○ PV technologies	PV effect, types of PV modules comparison of solar cell types , market trends	Lecture Demonstration	Handbook Tutors presentations PV samples e-learning platform videos	Computer Projector	NO
	Class: 45min (0,75h) Self-Study: 120min(2h)	1.3 PV system	Modules and BOS (inverters, batteries, controllers, distribution boxes, meters) description	Lecture	Handbook Tutors presentations e-learning platform video	Computer Projector	NO
	Class: 45min (0,75h) Self-Study: 60min (1h)	1.4 Types of PV systems/ applications	Grid connected/ stand-alone systems, residential, industrial	Lecture	Handbook Tutors presentations e-learning platform video	Computer Projector	NO
	Class: 30min (0,5h) Self-Study: 60min (1h)	1.5 Benefits of PV technology	Environmental and economic benefits	Lecture	Handbook Tutors presentations e-learning platform	Computer Projector	NO
MODULE 2. DESIGN PRINCIPLES (class: 9hrs/540min, lab: 3hrs, 180min, self-study: 6hrs/360min)	Class: 120min (2hrs) Self-Study: 240min (4hrs)	2.1. Site Survey	Climate conditions, shading analysis, array orientation, angle definition; roof/ wall structure, mounting methods	Lecture Group exercises	Handbook Tutors presentations e-learning platform	Computer, Projector Prepared activity Worksheets Calculator, pen, paper	YES
	WEEK 1 - DAY 2 : 7,5 hrs (class 4,5 hrs/270min, lab: 3hrs, 180min)						
	Class: 180min (3hrs) Self-Study: 480min (8hrs)	2.2. System Sizing and Design	Sizing the PV array, sizing BOS, performance calculations and electrical diagrams. Examples	Lecture Group exercises Case Studies analysis	Handbook Tutors presentations e-learning platform Simulations	Computer Projector Prepared activity Worksheets Calculator, pen, paper	YES
Class: 90min (1,5h) Lab: 3 hrs(180min) Self-Study: 7hrs (420min)	2.3. Simulation Software	Simulation description, examples	Lecture Online Group exercises Demonstration lab practice Case Studies analysis	Handbook Tutors presentations e-learning platform Simulations	Computer Internet Projector Prepared activity Worksheets Calculator, pen, paper	YES	



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CERTIFIED INSTALLER

## PVTRIN Pilot Courses

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## Pilot Training courses




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8 courses in 6 Countries - 400 applicants, 180 trained

COUNTRY	APPLICATIONS	TRAINEES
Bulgaria	34	20
Croatia	62	26
Cyprus	42	25
Greece	124	45
Romania	106	45
Spain	32	20

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## Training implementation



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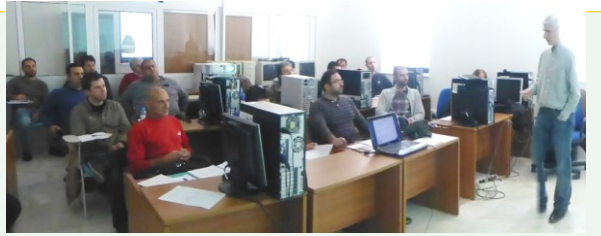




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## Training implementation



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## Certificates award ceremony in Cyprus

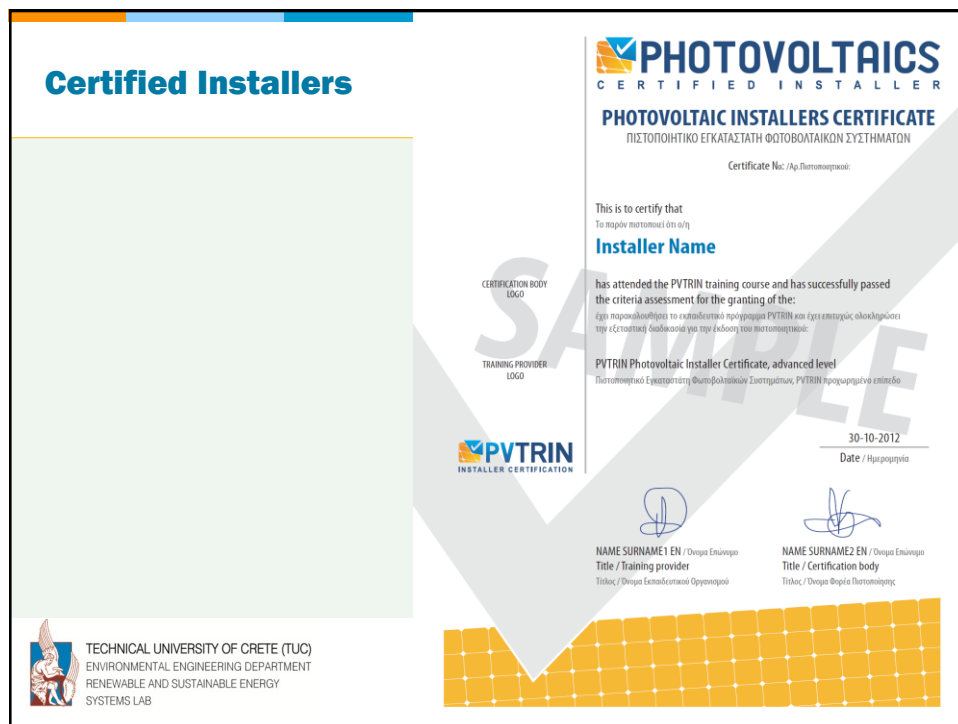


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## Contact us

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