

Training and Certification Scheme for PV installers

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Abstract

EU's strategy for the coming decades sets specific targets for a sustainable growth, including reaching a 20% share of renewables in final energy consumption till 2020 (Renewable Energy Directive). To achieve that, a number of initiatives and measures have been in force. The favorable European policies as well as the Member States' supporting legislations have resulted to high market growth for photovoltaics (PVs). However, the PV technologies' application requires highly qualified technicians for PV installation, repair and maintenance. So, to meet the market challenges, the appropriate training systems and certification schemes need to be developed in order to validate the competence of the installers and to ensure efficient and good functioning of installed PV systems. This is the scope of the European initiative PVTRIN, supported by the Intelligent Energy Europe programme of the European Commission, which focuses on the development of an appropriate training and certification scheme for technicians active in the installation and maintenance of small scale PV systems.

This paper presents relevant experiences of EU markets, the certification scheme's development methodology, defined requirements and documentation, as well as the initial response of pilot actions.

Keywords: Photovoltaic, PV, Education and Training, Qualification, RES Installer, Certification

1. Introduction

The installation of a PV system is a complex task, not only from the technical point of view where installers must have knowledge about DC electricity and safety, in parallel with roofing skills, but also from the financial and legal aspects as -in most countries- PV systems receive financial incentives and are subject to a number of administrative rules and constrains. PVs are considered as an expensive energy technology, thus the highest possible performance of a PV system is the main concern of the investors, as well as of the market actors. Installers must not only perform technical tasks correctly and precisely, but also must provide customers with appropriate information about incentives, investment costs, payback time and other regulations critical to the installation of their PV system.

The fast growth of installed PV capacities in Europe during the recent years has created high demand for qualified installers. The PV industry forecasts a total installed capacity of over 600 GW for 2030 (paradigm shift scenario) [1]. In EU, 465.000 PV jobs will have been created in 2015, reaching 900.000 in 2020; almost half of them in installation and maintenance of systems. Obviously, the need for quality installations calls for skilled technicians and appropriate education. Currently, national markets are growing faster than the qualified PV installers force can satisfy. The shortage of competent workforce may result in a threat to the PV market. Certification schemes can provide reassurance that the installer has the capacity to complete a PV installation safely and effectively.

Along these lines, the RES Directive (2009/28/EC) is forcing the Member States (MS) for mutual acknowledged certification schemes [2]. The PVTRIN Training and Certification Scheme addresses the market needs and sets the base for the adoption of a mutual acknowledged certification scheme within EU MS.

2. European and Croatian legal framework for certification of installers

According to the Directive 2009/28/EC on the promotion of the use of renewable energy sources (RES) stipulates implementation of certification schemes or equivalent qualification schemes for installers of small scale RES systems (small-scale biomass boilers and stoves, solar PVPV and solar thermal systems, shallow geothermal systems and heat pumps). These certification schemes should be implemented by the end of 2012; each MS shall recognize certification awarded by other MSs in accordance with criteria laid down in Directive. These criteria include general requirements for national appointed body, training course and training provider, examination as well as relevant work experience and previous education for installer who has undergone training and certification [2].

Croatia has introduced a new Tariff System for Production of Electricity from RES and CHP in June 2012, along with other changes in regulations regarding RES. This Tariff System introduced novelty for solar power plants, as they will be funded only if they are installed by authorized installer. Ministry responsible for construction, in cooperation with ministry responsible for energy, shall issue criteria for determining the quality of the equipment and works. This accreditation scheme shall be based on EN 45011. Until mentioned accreditation and certification come into full operation, the authorised installer is a legal person or an individual registered for electrical installation work that has employed at least one licensed electrical engineers, in accordance with regulations governing construction [5].

3. Experience from other markets

Across Europe the availability of certification schemes for PV installers varies greatly between Member States. Many do not have certification schemes, although training courses leading to qualifications for PV installers are often available. Where certification is available sometimes a number of different schemes operate, usually in different regions. Where training courses are available these generally have different eligibility requirements and qualifications. PVTRIN partners have identified several different existing certifications schemes in EU. Indicatively:

In France, non-profit association by professional and industrial associations Qualit'EnR was created in 2006. This association manages quality labels for installers of small-scale RES. This quality scheme is a voluntary certification process, and a label is delivered to the companies for a 3-year period. PV installers are covered with QualiPV label, and may choose to be QualiPV-E for electricity services and/or QualiPV-B for roofing services. Training course include 3 days training for QualiPV-E and 1 day training for QualiPV-B. In order to obtain label, previous experience is needed.

UK introduced Microgeneration Certification Scheme (MCS) based on EN 45011, with main focus on quality of renewable technology products and installations, but also covers certification of installers. Certification against this scheme includes the whole processes of PV installation; quality management and installation are assessed. The certificate is issued only by UKAS accredited certification scheme that are licensed to operate MCS scheme [6].

In 2011, Austria introduced a certification scheme for RES installers, based on ISO/IEC 17024. Training and certification of PV installers, under programme "Photovoltaic installer and planner" is

delivered by Austrian Institute of Technology. Training courses are scheduled for eight days: seven days in theory training and one for practical training.

In Italy, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development has developed training courses for renewable energy systems including both the design and installation of PV systems. The courses include distance learning and classroom-based training and are delivered by independent training providers that have been approved by CEPAS – a non profit Italian personnel and training courses certification body accredited to ISO/IEC 17024 by Accredia, the Italian National Accreditation Body.

In Netherlands, there is also a certification scheme for PV installation companies operated by the KBI Foundation. Under this scheme independent certification bodies are licensed by KBI to assess and certificate PV installation companies. Certification is valid for 3 years and is maintained through annual audits. The requirements of the scheme include: assessment of the legal status of the company and appropriate training and/or experience of employees.

In Spain there is an initiative led by ‘Asociación Española de Normalización y Certificación’ in collaboration with Federación Nacional de Empresarios de Instalaciones Eléctricas y Telecomunicaciones de España aiming to develop certification for low voltage installations by specialists in renewable energy services and PV installers in particular. The certification scheme includes assessment of: quotation and contract procedures; quality management system; installation and maintenance procedures. Furthermore, an internationally recognised diploma in the field of PV installation is also available from the Centro de Estudios de la Energía Solar.

4. Project PVTRIN – European initiative toward certification of installers

The PVTRIN Initiative – Training and Certification of PV Installers - was launched on the basis of the Directive 2009/28/EC requirements and is co-financed by Intelligent Energy Europe programme of European Commission (fig.1). Its scope is the development of an appropriate training course, training materials and certification scheme for installers of small scale PV systems. PVTRIN is, initially, implemented in six countries which present a different level of market maturity and growth: Greece, Bulgaria, Croatia, Cyprus, Romania and Spain.

In the frame of the action, targeted fieldwork researches have been conducted highlighting the market needs and specific characteristics, the industry’s considerations and the investors’ opinion and perceptions in the participating countries. The findings have provided guidance for the certification procedures and requirements, the specific knowledge and skill areas to be addressed, the existing workforce’s level, most common technical failures, as well as for the auditing mechanisms and other aspects of the certification. Moreover, a consulting instrument, the National Consultation Committee, was established with the participation of the key stakeholder groups, involving national authorities, policy makers and key market actors. The interaction with the stakeholders revealed critical issues to be taken into account for the scheme’s development and in parallel, creates a positive ground for consensus and support as concerns the establishment and wider adoption of the certification into the national markets [3, 4].

The development and implementation of the PVTRIN certification scheme will, short term, result to a pool of competent local technicians, skilled at installing PVs according multinational quality standards. This guarantees the best performance of PV installations, lowering risks or technical failures during the system’s installation and life cycle. Long term, PVTRIN will contribute to the PV market growth, facilitate job mobility within Europe, support the MS to meet their obligations for acknowledged

certifications for RES installers till 31/12/2012 and enforce them to achieve the mandatory target of a 20% share of energy from RES in overall Community energy consumption by 2020 [4].



Fig. 1. PVTRIN project's logo

The PVTRIN action plan is illustrated in Figure 2:

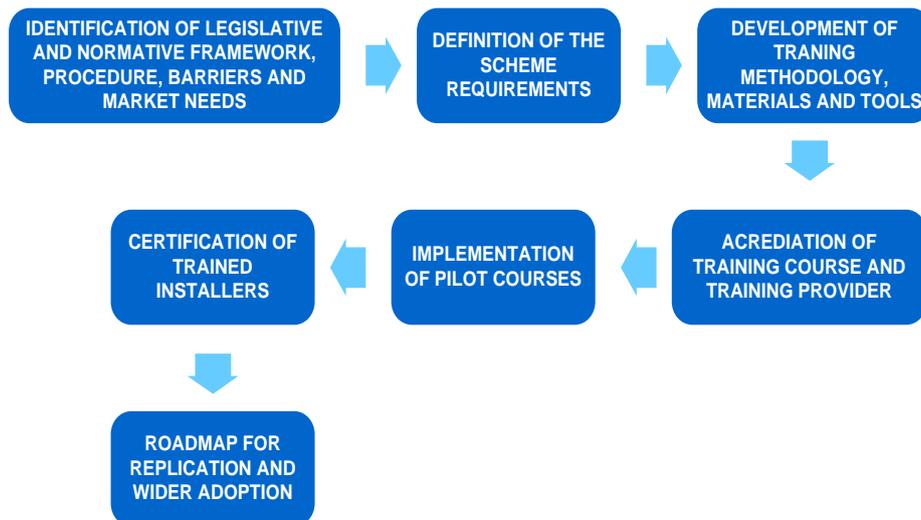


Fig. 2. Development of the PVTRIN project

4.1. Identification of market needs – legislative and normative framework

In each participating country a fieldwork research was conducted in order to record attitudes, perceptions and needs of the PV market actors regarding the training and certification of PV installers. In total, the fieldworks included 196 responders from different sections of the PV market. Around 80% of responders have accepted that the certification of professional skills, according to internationally accepted standards, will improve the PV technology competitiveness and will contribute to the market development. However, different attitudes in different countries are recorded towards the most important measures to improve the quality of PV installation, but technical and certified training were recognized as one of the most important. The findings of this field research are taken into account for the implementation of training course and certification scheme in each country.

In most countries, there is lack of certified training courses for PV installers, which is quite expectable due to the low development of the market in some countries. In some countries (Bulgaria, Croatia), a PV installer is not even recognized in the classification of occupations. Training for PV installer is usually provided by secondary technical schools as upgrading to the installer skills or by the equipment distributors as an introduction to install and maintain their equipment. In that view, most of the current installer workforce employed in installation and maintenance of PV systems are electricians or electrical engineers with experience in work with common building's electrical installations.

The PV installers' tasks were analyzed in order to define appropriate requirements for the assessment of installers, to establish the requirements for accrediting the training course and to develop curriculum for PV installers' training. Critical qualifications and skills expected for any qualified PV installer for efficient PV installation and maintenance of system were identified. Indicatively:

- **Working safely with PV systems.** The installer must maintain safer work habits; safely and properly use required tools and equipment, maintain personnel protection, to be aware of safety hazards and to prove know how to avoid them. Also, installer must be able to identify electrical and non-electrical hazards association with PV installation, and to take preventive measures.
- **Conduct a site assessment,** with emphasis on identifying tools and equipment required for site survey, determination of suitable location with proper orientation, sufficient area and structural integrity for installation of PV modules and suitable location for installing BOS (inverters, batteries etc.), illustrating possible layouts and schematics of array and equipment, identifying site specific hazards, and interpreting climate data (solar radiation, air temperature) for site.
- **Select and size a PV system.** Based on the results of site assessment, the installer must determine suitable size of the system and all components, identify PV module layout and electrical configuration, identify a mechanical design and required components and estimate annual energy performance of proposed system; including also determination of design current and voltages, capacity of system conductors, protection devices (earthling, surge suppressors, lightning protection).
- **Installation of the system in the field.** The installer must be able to: apply electrical and mechanical design, to install modules in array in proper configuration, label, install and terminate electrical wiring, use appropriate DC junction boxes and isolation switches, verify earthing system, utilize drawings and schematics for assembling of modules and support structures. Also, after the installation, installer must inspect entire installation and check system's electrical and mechanical installation. Installer must check and verify overall system functionality and performance, demonstrate procedure for connecting and disconnecting the system and explain safety issues associated with operation and maintenance of the system.
- **Maintaining and troubleshooting of system;** including the analysis of technical documentation, identification of maintenance needs, analysis of production, identification of typical installation mistake and failures and performing diagnostic procedure in case of system failure.
- **Quality management and customer care.** The installer should understand and apply all necessary quality parameters and EU standards associated to the system components and processes, as well as all customer case activities (delivery, final testing and handover, warranties, service, repairs and complaints handling).

4.2. Certification scheme requirements

As already referred, in many EU MS there is no operational certification scheme for PV installers. On the opposite of the lack of certification schemes, there are a number of training courses and training providers that can deliver training course for PV installers based on PVTRIN criteria and standards.

The scope of PVTRIN Certification is to set the base for adoption of a mutual acknowledged certification scheme within EU. Thus, PVTRIN certification must fulfill requirements of 2009/28/EC Directive stated in Annex IV:

- To be transparent; scheme requirements should be public, subject to review and approval by national bodies,
- To include an accredited training course with both theoretical and practical training, and final examination of installer that confirms their skills,
- To issue certificates by an appropriately accredited organisation
- To be offered to the installers with work experience, in case of PV installer training as a electrician,
- To provide refresher seminars and events necessary to maintain certification.

Beside requirements stated in RES Directive, an appropriate certification scheme must meet legal and institutional requirements and be compatible with the legislative framework for each MS, as well as maintain and enhance the reputation of the PV industry by underpinning safety, quality and performance of PV installations, in order to minimise complaints and eventual underperformance of the systems.

Key areas of the requirements for PV installer certification scheme, as well as for training methodology and structure, were defined and they include: applicable regulations and directives, installation maintenance requirements, site specific issues, system performance, technical competencies, quality management and customer care.

An installer undergoing the certification process should have relevant training and experience demonstrated through both theoretical and practical examination. In this case, installers should prove all the necessary skills needed to perform defined tasks, as described before.

4.3. Training materials

As a basis for the training course, appropriate training materials and tools have been developed within the project's activities, in order to provide the PV installers with applied knowledge, practical tips and best practice recommendations for efficient and high quality installation and maintenance of PV systems. The materials are developed based on the task analysis performed in the first steps of the project, with special aim to be easily used by practitioners, as well as by trainers, and to serve them not only during the training course, but also during the installation process and fieldwork. The training materials and tools developed under the PVTRIN project include handbook and troubleshooting guide for PV installers, list of resources, trainers' manual, etc. [7].

The PVTRIN handbook contains the theoretical training of the PVTRIN course (Table 1). As well as comprehensive exercises and other useful information for trainees as further reading lists (suggested books, online publications etc), useful links, glossary and references.

Table 1. PVTRIN Handbook structure

PVTRIN training modules
1. Solar Basics
2. Design Principles
3. BAPV and BIPV
4. Installation – Sitework
5. Case Studies – Best Practices
6. Example Installation of a small scale PV on a Building
7. Maintenance and Troubleshooting

8. Quality Management and Customer Care
9. Glossary of Terms
10. Annexes
11. Further Reading

Beside of the handbooks and other publications, an e-learning platform for distance learning is developed under the PVTRIN project. E-learning platform offers practitioners possibility to evaluate their knowledge and skills acquired at training courses, and to acquire additional knowledge.

4.4. Pilot courses

Eight courses have been scheduled in the PVTRIN participating countries as pilots.

The training course's structure, duration and curriculum are based on the outcomes of the developed training methodology and the analysis of the professional framework. The course consists of two parts, the theoretical and practical training with balance of classroom instructions, presentation of case studies, practical exercises and actual hands-on work with PV system. The first part describes the underpinning knowledge that is required to understand the theory behind PV systems, related regulations, safety requirements and installation and testing. The second part concerns the application of practical skills in carrying out installation and testing.

5. Conclusion

The RES market development, followed by the rapid growth of PV installations, has created high demand for qualified installers. The establishment of common acknowledged quality standards to professional training and certification of PV installers can provide reassurance to customers that an installer has the knowledge, skills and competences to complete PV installations safely and effectively.

The European Initiative PVTRIN addresses the market needs by developing an appropriate training and certification scheme for technicians -who are active in the installation and maintenance of small scale PV systems- providing the key components for the development of a European acknowledged certification scheme. The implementation of the certification scheme provides benefits for the installers, the PV industry and the society. As a result of the PVTRIN's action plan, a pool of local technicians, competent at installing PV systems, according to multinational quality standards, will be established in the participating countries.

The PVTRIN certification scheme could be adapted to other small scale RES installations, and could be the base for implementation of certification schemes for solar thermal installers, small scale biomass stoves and boilers installers and heat pump installers, as requested in Directive 2009/28/EC. Thus, the PVTRIN certification will provide a supporting instrument, for EU Member States, to meet their obligations for acknowledged certifications for RES installers till 31/12/2012.

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