CERTIFICATION AND QUALIFICATION OF PV INSTALLERS IN EUROPE. DEVELOPMENT OF THE PVTRIN CERTIFICATION SCHEME

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ABSTRACT: The European Energy and Climate Change policies, as well as the supporting EU Member States' legislations have resulted in high market growth for photovoltaics. Applying PV technologies however, requires highly-qualified technicians to install, repair and maintain them. Until today, national markets have been growing faster than the qualified PV installers force can satisfy. The PVTRIN training and certification scheme, creating a qualified installer workforce, supports the European Photovoltaic industry in addressing the need for skilled technicians. It will, initially, be implemented in six (6) countries: Greece, Bulgaria, Croatia, Cyprus, Romania and Spain, incorporating the criteria set by the 2009/28/EC Directive for qualification schemes in each Member State, as well as the national legislation. The certified installers will gain professional competitive advantage, improving their technical skills and knowledge. Having more qualified PV installers should lead to fewer technical failures, more effective operation of PV systems, better maintenance procedures, and lower maintenance costs. The resulting increased confidence of PV investors should then lead to higher market growth. The increased PV technology penetration to the energy mix, will assist the EU countries in achieving the mandatory target of a 20% share of energy from RES, in overall EU energy consumption, by 2020.
Keywords: Photovoltaic, Education and Training, Qualification and Testing, RES Installer, Certification

1 INTRODUCTION

The photovoltaic (PV) market has been booming over the last decade, reaching the 39.600 MW installed capacity at the end of 2010. Within Europe, the demand for the installation of PVs is increasing dramatically due to the introduction of financial incentives for the generation of 'green' electricity and the increasing awareness of sustainability and climate change issues [1], [2].

According to the industry's forecasting scenarios, this trend will continue the next years, estimating more than 600 GW total installed capacity in Europe, till 2030 [3]. The high growth rates of PV installations, further favoured by the EU and national supporting policies, will require a significant number of highly skilled installers to install, repair and maintain them. More than 1.400.000 PV jobs (including research, production, wholesale, installation and supply) are forecasting till the end of 2030 [4]. Furthermore, the interested parties (manufacturers, developers, investors) seek certified skills and quality assurance in all phases of a PV installation (design, installation and maintenance). The shortage of qualified workforce may result to a threat for the PV industry.

Certification schemes can provide reassurance to customers that a contractor has the capacity (organisation, competence and equipment) to complete a PV installation safely and effectively. The current status of PV qualifications features that skilled staff is missing in most EU Member States (EU MS). Across Europe the availability of certification schemes for PV installers varies greatly between MS. Some do not have certification schemes, although training courses leading to qualifications for PV installers are often available. In others a number of different schemes operate in different regions. Where training courses are available, these generally have different eligibility requirements and qualifications. The lack of a competent installers' workforce, to cover the industry demand, is more evident in the South Eastern Europe. Appropriate training opportunities are currently very limited or inexistent in most of the countries [5].

To meet the market challenges, the appropriate education and training systems as well as certification schemes, which will validate the competence of the installers, need to be developed in order to ensure efficient installation and good functioning of installed PV systems.

Figure 1: PV Installation

2 THE EUROPEAN INITIATIVE PVTRIN

The PVTRIN Training and Certification Scheme, which is developed within the framework of the PVTRIN European project and co-financed by the Intelligent Energy Europe programme of the European Commission, sets the base for the adoption of a mutual acknowledged certification scheme -that will be consistent to internationally acknowledged quality standards- within EU MS.

2.1 Methodology

The PVTRIN Certification will be initially implemented in a balanced group of regions with different market maturity, including countries with a high PV penetration and significant experience in BIPV installation (Spain), others with a recently market awakening and

large potential (Greece, Cyprus, Bulgaria), others with poor market performance (Romania, Croatia). The experience of countries with successful examples and extended know-how on developing vocational accreditations standards has been taken into account.

The PVTRIN's action plan [6], [7] foresees the following steps, as illustrated in figure 2:

- Comparative analysis of the industry and market needs on PV installation and maintenance, as well as the national legislative and normative framework in 6 countries
- Definition of the professional framework for PV installers and development of an appropriate training methodology
- Development of appropriate training material for installers and trainers; also practical training tools and an e-learning platform for a flexible and adaptable training procedure
- Development of a transparent and clearly defined certification scheme, focused on small scale applications, in order to accredit the training course for installers and to provide mutually acknowledged quality standards within EU countries
- Implementation of pilot training courses, resulting to a pool of skilled and certified PV installers in 6 of the participating countries
- Evaluation of the main developed methodologies, materials and tools, in order to ensure that the project's outcomes will match the pre-decided quality standards
- Establishment of a mechanism to facilitate replication and exploitation of projects deliverables throughout Europe.

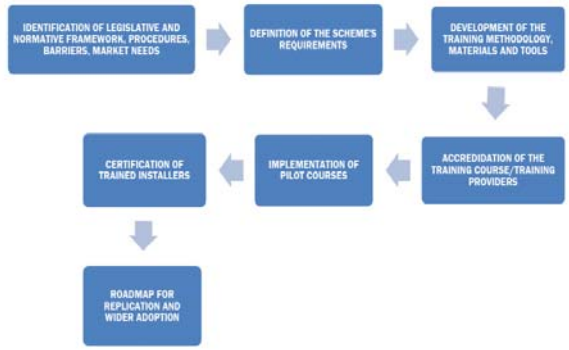

Figure 2: PVTRIN's development steps

2.2 Development of the PVTRIN certification scheme

At first, the national legislative and normative framework regarding professional training, qualifications and certification, in the 6 participating countries, was identified and compared. Also potential synergies and barriers were evaluated.

A fieldwork research was conducted in the participating countries, in order to record the attitudes, perceptions and considerations of the PV industry actors regarding the training and certification of PV installers. A second survey has measured the satisfaction level of PV investors as concerns the quality of the installation process of their system.

In order to incorporate the genuine market needs and to assure the broadest possible support, the key stakeholder groups are involved to transfer the market's experience and to provide consultation. Moreover, relevant initiatives and existing certification schemes for PV/RES installers -in Europe and internationally- were reviewed in order to exploit existing knowledge and expertise and to create links and synergies with relevant initiatives.

Through the above methodology, the under development scheme integrates the national legislation, the market's needs and the PV industry's requirements. Furthermore, the training and certification scheme incorporates the criteria set by the 2009/28/EC RES Directive regarding requirements for certified training courses and training providers, providing thus a supporting instrument for EU Member States to meet their obligations for acknowledged certifications for RES installers till 31/12/2012 [8].

The developed documentation provides guidance for the certification procedure, the design and installation requirements, the required competences and training needs of technical staff, the appropriate infrastructures and technical facilities, the auditing mechanisms. The scheme requirements include, among other issues, applicable regulations and directives, installation and maintenance requirements, site specific issues, system performance, technical competencies, quality management, customer care.

The transferability and replication of the certification by other organisations in the participating countries, as well as by other EU MS, are taken into account. Also, procedures for the maintenance of the certification through reassessment procedures will be defined.

2.3 The National Consultation Committees

A consulting and supporting instrument, the National Consultation Committee (NCC), was established in the 6 targeted countries, with the participation of national authorities, policy makers and key market actors (i.e. PV/RES industry associations, professional unions and installers associations, vocational training organizations, accreditation/certification bodies, chambers of commerce, consumers/investors associations). 42 organisations (Fig. 3) have declared their support and interest, involving their representatives in the project's activities, as members of the NCCs. The key stakeholders confirmed their intention to actively contribute according to their experience, expertise and area of influence.

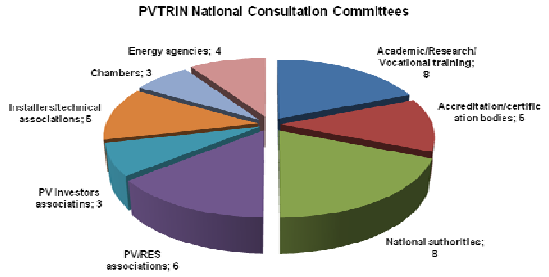

Figure 3: Synthesis of PVTRIN Consultation Committees

The interaction with the stakeholder groups revealed significant issues to be taken into account for the scheme's development. They declared that establishment of certification schemes may improve the market function and will contribute to more efficient installations. However, they emphasized that decisions regarding the certification requirements and criteria should take into consideration not to add more bureaucratic barriers to the market development or costs to the investors. They

admitted that many technicians do not have the appropriate competences to install PV, much more are not aware of basic safety and sizing principles; which means high risk of accidents and technical failures. Experts highlight the importance of practical training in PV. Project-oriented education, further training in the industry, and/or lab courses where practical experience can be obtained, are strongly encouraged.

3 MARKET RESEARCH

In order to record the attitudes, perceptions and considerations of the PV industry actors regarding the training and certification of PV installers, a fieldwork research was conducted in 6 countries; 196 responders including distributors, authorized dealers, wholesalers, engineers, technicians and building constructors, professional associations, chambers and other market actors engaged with the PV installation. 8 of 10 accepted that the certified professional skills -according to internationally acknowledged quality standards- will improve the competiveness and will contribute to the industry's healthy development.

The cross-national analysis of the data highlights the different markets' needs, industry's considerations and investors' opinion and perceptions [7]. Indicative findings of the survey are listed below:

- 12% evaluate the quality of existing PV installations not satisfactory, where 41% consider it just tolerable.
- 60% of them accept that operational problems, due to technical failures, may occur during the installations; 20% of them consider this fact frequent. It is important to mention that in Spain, where a large number of installations exists, this percentage reaches the 32%; in Romania 43% and in Greece 16% - highlighting the importance of training and assessing the skills of the installers.
- As regard their opinion for the current installers workforce skills, the PV Industry/market actors believe that their qualifications are rather satisfactory as concerns sizing, electrical/ mechanical design; however when it comes to the compliance to safety rules, the integration in buildings and the proper maintenance of the systems they rate them as rather inadequate (Fig. 4).
- Responders highlight the importance of appropriate training of PV installers in their country (Fig.5) and the adoption of quality standards, as regards PV installations, (Fig. 6). 75% recognized that the adoption of a mutually acknowledged EU certification scheme for PV installers is important for the healthy PV market development (Fig.7).

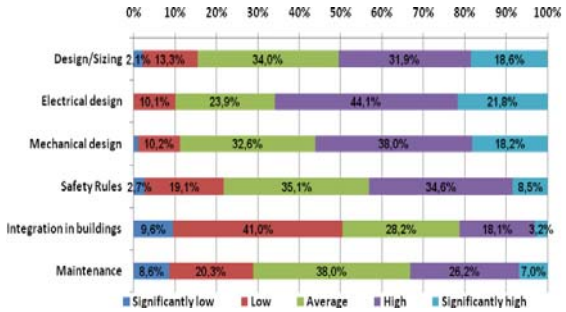

Figure 4: Rating of the current installers' workforce skills according to the PV industry/market actors' opinion

The most important measures in order to improve the quality and performance of the PV installations, according to the opinion of the PV industry/market actors are illustrated in table 1.

Table 1: Most important measures to improve the quality of PV installations

	1st	2nd	3rd
Spain	Equipment certification	Systems certification	Certified training of installers
Romania	Certified training for installers	Technical training for installers by companies	Systems certification
Greece	Systems certification	Technical training by companies	Certified training of installers
Cyprus	Technical training by companies	Certified training of installers	Methods to confirm the installer's skills and adequacy
Croatia	Technical training by companies	Certified training of installers	Identified qualifications framework
Bulgaria	Equipment certification	Systems certification	Technical training by companies

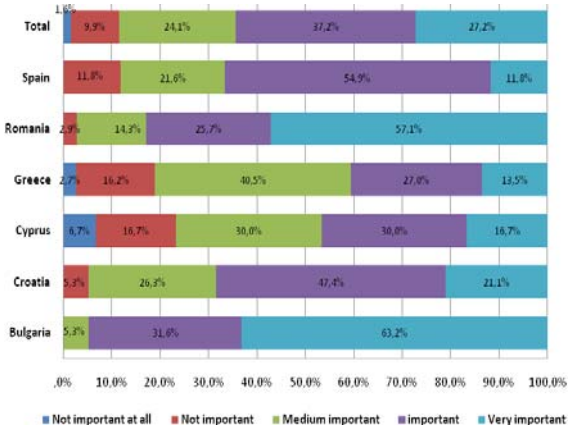

Figure 5: Importance of appropriate training for the PV market growth

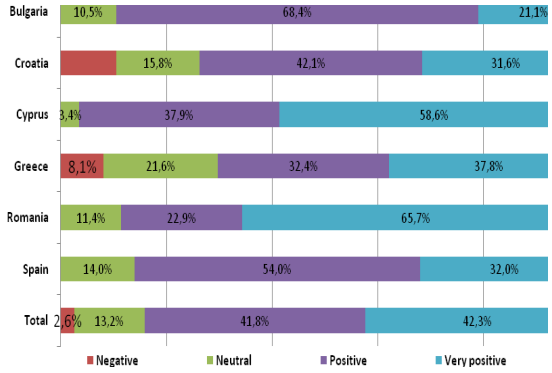

Figure 6**:** Attitude for the establishment of quality standards leading to installers' certification

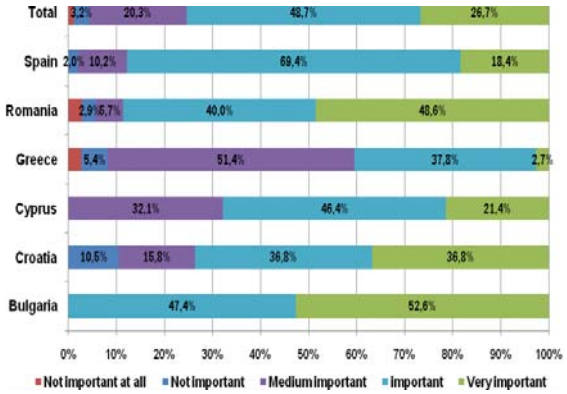

Figure 7: PV market actors' opinion on the importance of adopting an EU certification scheme

A second survey have measured the satisfaction level of PV investors (128 responders) as concerns the quality of the installation process; a significant incidents of technical failures were reported. Indicative findings are listed below:

- The basic motive to invest was to make profit, following to saving money from reduced electricity consumption.
- 91% declare satisfied or very satisfied from their PV installation. However, 42% mentioned technical failures
- Inverters (40%) and fuses (20%) are the parts that the malfunctions occur more often. According to their perception the most probable reasons for these malfunctions are the "PV system components failure". However it is important to mention that 25% believe that these failures are due to failures 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
- 74,4% admit that they would be more confident if their system was installed by a certified installer and 52,4% are willing to pay more to have their system installed by certified staff

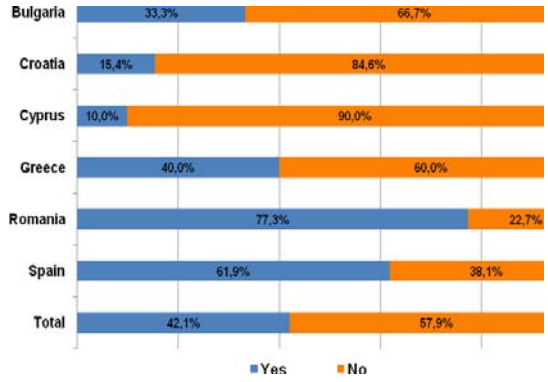

Figure 8: Are there any technical malfunctions occurred during your system's operation?

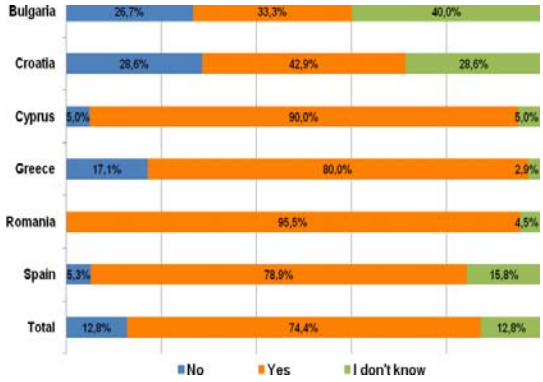

Figure 9: Would you be more confident if your system was installed by a certified installer?

4 CERTIFICATION REQUIREMENTS

In many MS there is no certification scheme in operation that enables PV installers to demonstrate their competence and quality of work to potential clients. This represents a barrier to the uptake PV within Europe since the complexity of PV systems and their high cost means customers are reluctant to make the required financial commitment without the reassurance that a certificated installer would bring. Despite this lack of certification schemes, relevant surveys have confirmed that there are a number of training courses and training providers that could be used to deliver training courses for PV installers based on PVTRIN criteria and standards.

The scope of the PVTRIN Certification is to set the base for the adoption of a mutual acknowledged certification scheme within EU MS. The PVTRIN certification scheme aims to:

- fulfil the requirements of 2009/28/EC Directive (Annex IV) i.e.:
  - to be transparent (scheme requirements should be public, subject to review and approval by national bodies and be widely available)
  - to include an accredited training course including theory and practical examinations that leads to the certification of PV installers
  - to include requirements for regular training updates as part of the certification maintenance requirement
- meet the legal requirements and be compatible with the institutional framework for each member state
- maintain and enhance the reputation of the PV industry by underpinning the safety, quality and performance of PV installations, minimising complaints, and dealing with those swiftly and effectively should they arise.

During the project's development the requirements for a PV installer certification scheme, as well as the training methodology and structure, leading to certification were defined. Key areas for the requirements will include:

- Applicable regulations and directives
- Installation and maintenance requirements
- Site specific issues
- System performance
- Technical competencies
- Quality management
- Customer care

A basic requirement is that the installer has relevant training and experience demonstrated through both written and practical examination. In terms of specific skills, installers should be able to design small scale PV systems effectively, including being able to estimate the energy performance of the system, working with electricity and working at height (e.g. on roofs). They should also be aware of building regulations, codes and standards as well as local incentive schemes, such as the feed-in tariffs etc. and to be capable of working in a safe manner. Appropriate tools should be used and customers should be provided with adequate documentation regarding their systems (use and maintenance instructions).

Key areas of the training course will include:

(i) the ability to work safely using the required tools and equipment and implementing safety codes and standards and identify electrical and other hazards associated with solar installations;
(ii) the ability to identify systems and their components specific to active and passive systems, including the mechanical design, and determine the components' location and system layout and configuration;
(iii) the ability to determine the required installation area, orientation and tilt, taking account of shading, solar access, structural integrity, the appropriateness of the installation for the building or the climate and identify different installation methods suitable for roof types and the balance of system equipment required for the installation; and
(iv) the ability to adapt the electrical design, including determining design currents, selecting appropriate conductor types and ratings for each electrical circuit, determining appropriate size, ratings and locations for all associated equipment and subsystems and selecting an appropriate interconnection point.

5 CONCLUSIONS

PV installations' fast growth has created a 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 a contractor has the organisation, competence and equipment to complete PV installations safely and effectively.

The PVTRIN initiative, which is co-financed by the Intelligent Energy Europe programme of the European Commission, 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:

- Creating a qualified installers workforce, the PVTRIN certification supports the EU PV Industry to address the need for skilled technicians. The increased confidence of PV investors will lead to market growth.
- The certified installers gain professional competitive advantage, improving their technical skills and knowledge; the certification provides the "passport" to the EU job market.
- Developers and engineers will profit by the existence of skilled installers. Involving them in their PV projects means efficient installations, less technical failures and satisfied customers.
- PV investors win confidence that the appropriate level of quality and performance is met and maintained for their PV system.
- National authorities will find a supporting instrument to meet their obligations for acknowledged certifications for RES installers.
- The entire society is to benefit; the higher PV penetration to the energy mix will reduce the greenhouse gas emissions improving citizens' quality of life.

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 and a greater number of technicians will be encouraged to advance their professional skills. Besides the positive effects of having a growing pool of well trained and competent PV installers, this perspective will also facilitate job mobility within Member States. 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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