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I. Introduction

This brochure has been developed in the framework of the European project “Install+RES”. The aim of the “Install+RES” project is to establish training courses for trainers and installers of small-scale Renewable Energy Systems (RES) in buildings. The brochure is intended to give information on how to become a certified installer of small-scale renewable energy systems (RES) in buildings, namely, photovoltaic, solar thermal, heat pumps and biomass systems.

The first part of the brochure illustrates how the next years and decades are expected to bring a further increased demand for renewable energy technologies in Europe. The question of why to pursue a certification as RES installer is highlighted by calling your attention to these developments and the recent growth of the renewable energy sector. To get a better picture of how to become a certified installer of small-scale Renewable Energy Systems (RES) in buildings, the second part summarizes the structure, content, entry requirements and outstanding features of the Install+RES courses offered in five European countries: Bulgaria, Greece, Italy, Poland and Slovenia.

For further information please visit the website of Install+RES under <http://www.resinstaller.eu>



II. Renewables in Europe

The significant increase in oil prices, the rising concerns about energy security as well as the effects of climate change put pressure on National Governments to take serious measures to ensure sustainable and secure energy production. Deployment of renewable energy technologies offers the possibility to create an environmentally friendly energy mix while reducing the energy dependency on limited sources. By early 2011, more than 119 countries¹ world-wide use policy tools to make renewable energy installations more attractive, turning renewable energy into a profitable business.

Renewable energy plays an important role in the energy strategy of the European Union. The European Union published the Renewable Energy Directive (Directive 2009/28/EC) on 23rd April, 2009, which sets the target of supplying at least 20% of the EU's energy consumption from renewable energy resources by 2020. In order to achieve the legally binding National targets, the Member States introduce measures such as Support Schemes designed to ensure that the share of energy from renewable sources equals or exceeds the National target set for their country. The binding targets to be reached by each European Member States according to the Directive 2009/28/EC are shown in the table below.

Table 1: Share of renewable energies among European Member States in 2005 and their mandatory national targets to be reached by 2020 according to the 2009/28/EC Directive [EC 2009].

Country	Share in 2005	Target for share in 2020	Country	Share in 2005	Target for share in 2020
Austria	23.3%	34%	Latvia	32.6%	40%
Belgium	2.2%	13%	Lithuania	15.0%	23%
Bulgaria	9.4%	16%	Luxembourg	0.9%	11%
Cyprus	2.9%	13%	Malta	0.0%	10%
Czech Republic	6.1%	13%	Netherlands	2.4%	14%
Denmark	17.0%	30%	Poland	7.2%	15%
Estonia	18.0%	25%	Portugal	20.5%	31%
Finland	28.5%	38%	Romania	17.8%	24%
France	10.3%	23%	Slovenia	16.0%	25%
Germany	5.8%	18%	Slovak Republic	6.7%	14%
Greece	6.9%	18%	Spain	8.7%	20%
Hungary	4.3%	13%	Sweden	39.8%	49%
Ireland	3.1%	16%	United Kingdom	1.3%	15%
Italy	5.2%	17%	Total EU	11.6%	21.4%

¹ Renewable Energy Policy Network for the 21st Century (REN21), "Renewables 2011: Global Status Report", pp. 11-13, [REN21]

III. Renewable Energy Systems

PHOTOVOLTAICS (PV)

The term “photovoltaics” (PV) is a combination of two words; “photo” from Greek roots meaning light and the word “voltaic” meaning electricity. The PV technologies convert solar energy (light) into electricity by using semiconductor materials; silicon being mostly widely used today. Direct current (DC) generated by the PV modules is usually converted into the more commonly used alternating current (AC) (Figure 1).

Applications of PV are usually distinguished as on-grid and off-grid applications. On-grid applications deliver either the surplus electricity (the portion that is not used by the producer) or all of the electricity produced into the grid. Roof-type systems on private houses and larger plants with capacities of several megawatts are typical application of on-grid systems. Off-grid applications do not have any access to the electricity grid and are mostly used for rural electrification and consumer goods applications.

After the discovery of the photovoltaic effect in 1839, the amount of photovoltaic applications has grown throughout the years, with a take-off in large scale installations since the beginning of the 21st century. Based on the National Renewable Energy Action Plans of the European Member States, electricity generated from PV in Europe will increase from 1470 GWh in 2005 to 83375 GWh in 2020² (Figure 2).

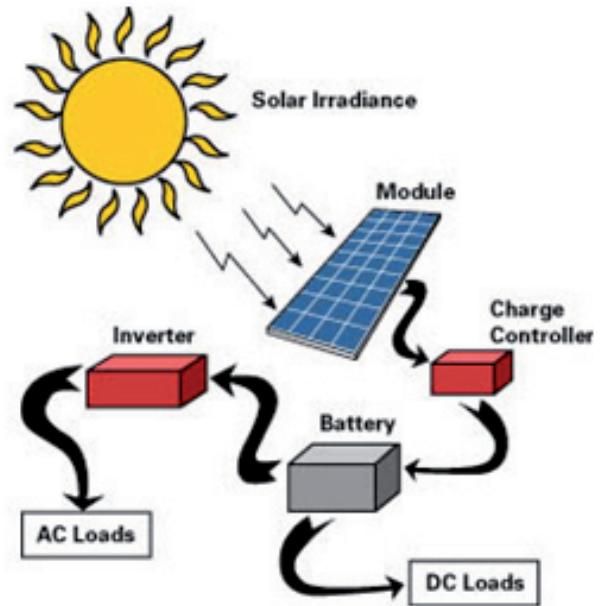


Figure 1: Illustration of a typical PV system. Source: European Photovoltaic Technology Platform; Photovoltaic Fact Sheets, January 2010

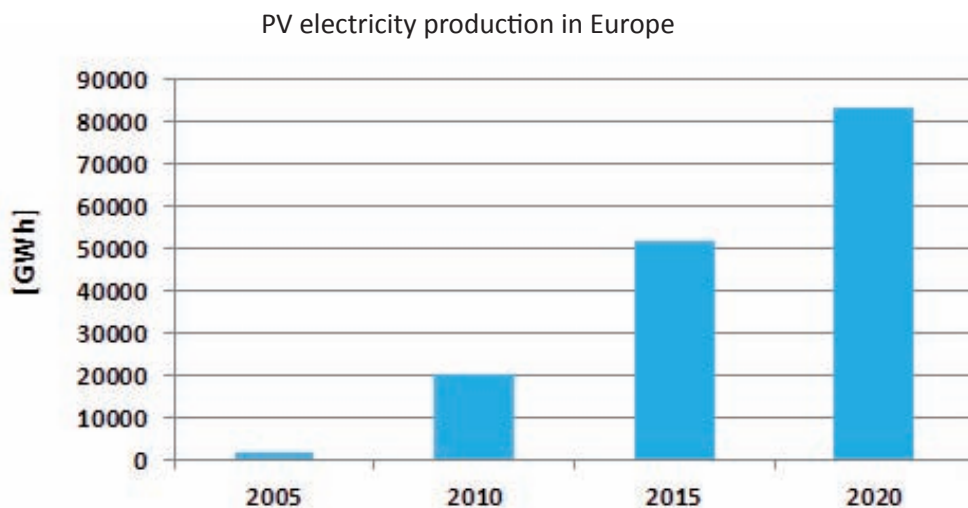


Figure 2: Projections of PV electricity production in Europe for the period 2005-2020 [ECN 2011]

² Energy Research Centre of the Netherlands (ECN) Policy Studies 2011, Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States [ECN 2011]

SOLAR THERMAL

Solar thermal offers another way of benefiting from the most abundant energy resource, the sun. The working principle of solar thermal is quite simple: the solar energy is captured by the absorber of a collector placed on the rooftop of the building. The absorber converts the solar radiation into heat which is then conveyed to a heat transfer medium- such as fluid or air. Water storage is implemented in solar thermal systems as it is required to store solar heated water for the night and for times when there is low irradiation (Figure 3).

A solar thermal system can be installed for a broad range of heat requirements, as small installations or as large thermal systems. Depending on the intended application, solar energy is often used for preparing Warm Drinking Water (WDW) or for auxiliary heating. Due to the variability of solar irradiation during a day and a year, solar thermal systems are built as bivalent heating systems. This means that along with solar storage another heat source is always included in the system technology, such as a condensing boiler.

The growth in the collector surface area in European countries and Switzerland, according to the data of the European Solar Heating Industry Association (ESTIF), was about 60% higher in 2008 as compared to 2007³. Based on the National Renewable Energy Action Plans of the

European Member States, the number of solar thermal installations in EU countries will further increase to meet the binding targets of the National Plans of the Member States⁴ (Figure 4).

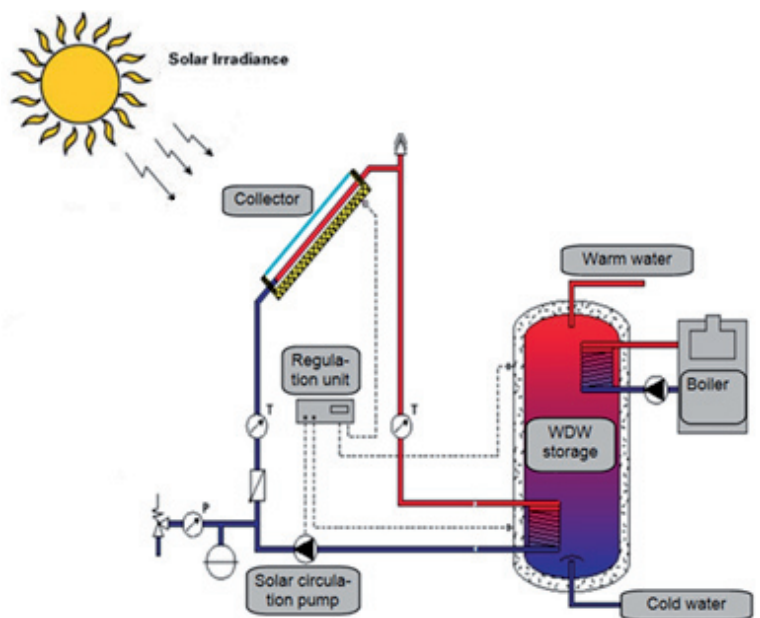


Figure 3: Illustration of a standard solar thermic system
Source: German Solar Energy Society (DGS)

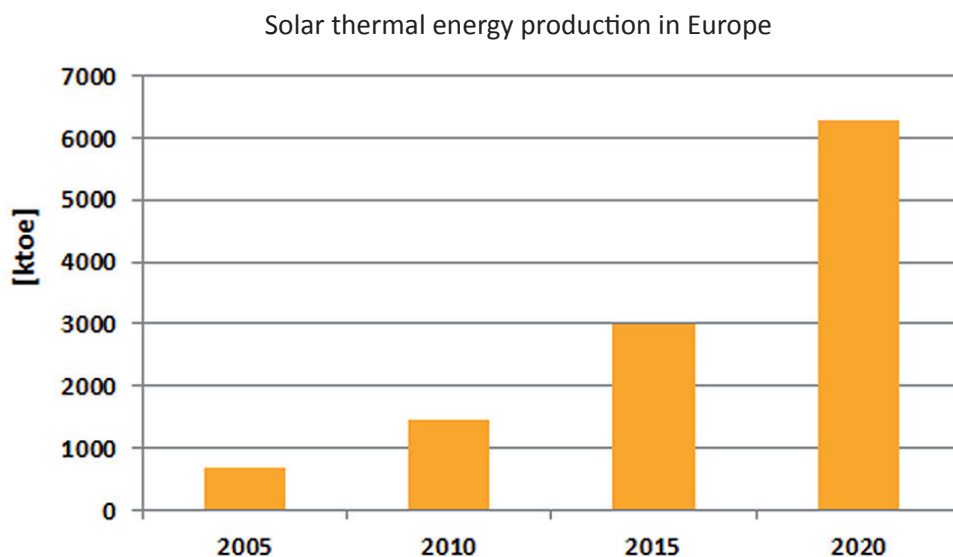


Figure 4: Projections of solar thermal energy [ktoe] in Europe for the period 2005-2020 [ECN 2011]

³ European Solar Thermal Industry Federation (ESTIF), 2011, Solar Thermal Markets in Europe Trends and Market Statistics 2010, June 2011 [STM 2011]

⁴ Energy Research Centre of the Netherlands (ECN) Policy Studies 2011, Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States [ECN 2011]

HEAT PUMPS

The heat pump is a universal solution for heating as well as cooling tasks and can be employed for the entire range of air-conditioning needs in domestic and commercial spaces. The heat pump has to be distinguished from the warm water heat pump. While the heat pump is used first and foremost for the purpose of heating (or cooling) rooms, it can also be used for heating water. Many classical heating and cooling tasks can be accomplished using the flameless technology of heat pumps, in an efficient and environmentally friendly manner. By using a small amount of drive energy (electricity, fuel or high temperature waste heat) heat pumps can transfer the energy potential from natural heat sources in the surroundings (such as ambient and exhaust air, soil and ground water) or from man-made heat sources (like domestic waste) to buildings (Figure 5). With a heat pump it is possible to acquire 75% of the required energy from the environment, so that with 25% of electrical energy 100 % of usable energy can be produced. A particularly widespread utilization range for heat pumps is opened up by combining them with concepts of energy recovery from low temperature sources and other renewable energy concepts.

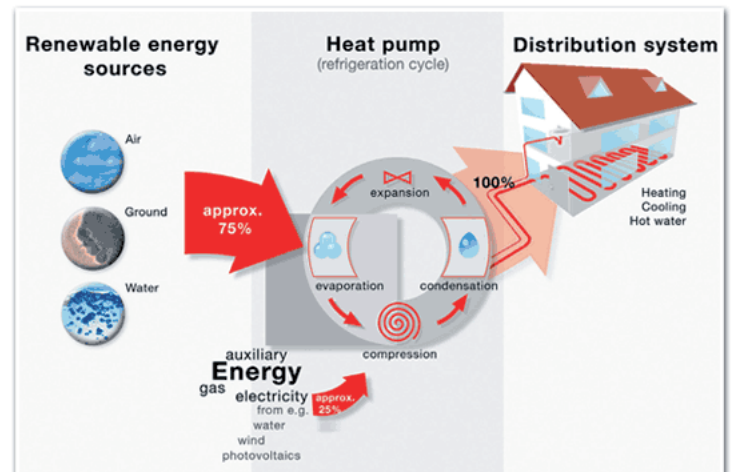


Figure 5: Operation principle of a heat pump
Source: European Heat Pump Association (EHPA)/Alpha Innotec

Due to their attractive features, the interest in investing in heat pumps is increasing not only in Southern Europe, which has a moderate climate but also in North European countries. The published National Renewable Energy Action Plans of the European Member States indicate that the thermal energy generated by the heat pumps will increase by 20 folds in the period for 2005-2020 (Figure 6).

Thermal energy production from heat pumps in Europe

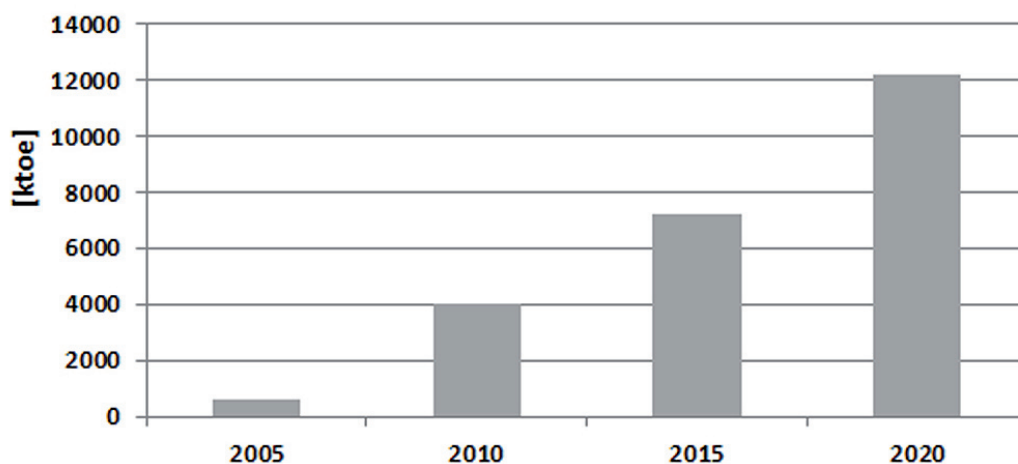


Figure 6: Projections of thermal energy production [ktoe] from heat pumps (aerothermal, hydrothermal and geothermal) in Europe for the period 2005-2020 [ECN 2011]

BIOMASS

According to the Directive 2009/28/EC⁵, “biomass” refers to the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste.

There are alternative ways of producing solid, liquid and gaseous fuels from biomass. Basically, one distinguishes between combustion to produce heat and combustion to generate electricity or utilization in the transport sector (biofuels). The combined production and utilization of electricity and heat (CHP: Combined Heat and Power) is becoming increasingly important in Europe (Figure 7).

In 2008, renewable energies covered about 10% of European energy demand, 65% of which is supplied by biomass (including biofuels), primarily from woody biomass with smaller contributions from waste, biogas and biofuels⁶. Having the highest share among the

renewables for the moment, biomass is promising attractive opportunities not only in meeting the electricity and heating demands but also in offering advantages in transportation. Projections for thermal heat production in Europe from solid biomass are shown in Figure 8.

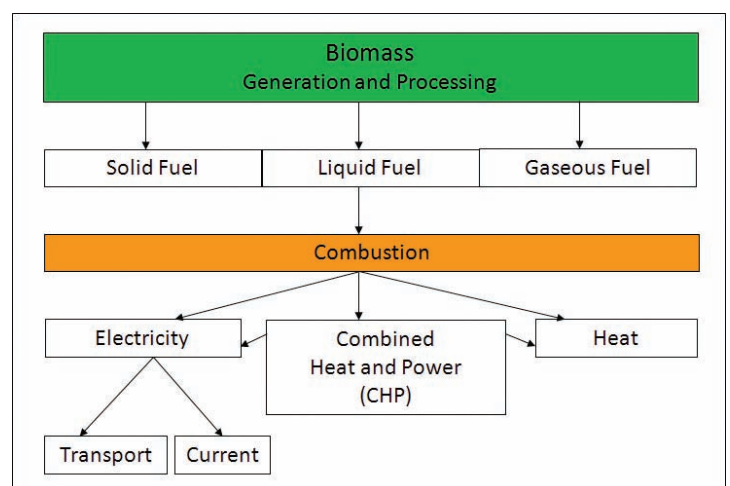


Figure 7: Scheme showing alternative routes for processing biomass and its utilization areas. Source: Biomass module of Install+RES training course material

Thermal energy production from solid biomass in Europe



Figure 8: Projections of thermal energy [ktoe] from solid biomass in Europe for the period 2005-2020 [ECN 2011]

⁵ The European Parliament and the Council of the European Union, Directive 2009/28/EC on the promotion of the use of energy from renewable sources [EC 2009].

⁶ German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Erneuerbare Energien in Zahlen-National und International Entwicklungen, [BMU 2010]

IV. Why become an Installer of Renewable Energy Systems?

Being a certified Renewable Energy System (RES) installer opens the doors to a wide range of attractive job opportunities in one of the most expanding and interesting economic sectors, fully supported by European and National legislations. In pursuit of achieving their mandatory targets, each European Union Member State encourages their citizens and enterprises to generate energy from renewables by installing Renewable Energy Systems (RES). RES offer many opportunities such as:

1. Reducing electricity bills

RES generate electricity, thus contribute to meet the energy demand

2. Benefiting from the support mechanisms provided by the National Governments

The support schemes provided by National Governments differ in the European Union amongst each country. Learning about the support mechanisms and the market needs helps to benefit most from the support schemes

3. Protection against fluctuations in fossil fuel prices

The fluctuations in oil prices do not concern RES owners because the RES create an energy-mix which avoids the reliance on a single energy source

4. Taking action against climate change by reducing greenhouse gas emissions

RES are defined as green or clean energy because they use resources which have not only the capacity to replenish themselves, but more importantly do not produce toxins or pollutants that are harmful to the environment.

The binding targets of the Renewable Energy Directive, the attractive support schemes introduced by European Member States and the rising interest of citizens and enterprises to invest in renewables have increased the demand of highly qualified RES installers. The quality of the installers plays a key role in providing customers with advice on how to benefit from the National support schemes. Further, a highly qualified installer can ensure the safety and the quality of the RES installations.

Most insurance premiums are based on the quality of the installers and the materials used. Installers lacking the necessary knowledge and skills can neither meet the demand nor can they properly address the answers of potential buyers, which might discourage them to invest in renewables. Installations with low quality damage the reputation of the installed RES and constitute a threat for the future of RES.

Continuous up-skilling is a must to keep up with the advances in RES and to ensure and provide the appropriate service and solutions to daily needs and problems of the customer.

V. What is special about Install+RES training courses?

The Install+RES training courses owe their outstanding features to the:

1. Hands on learning methodology
2. Certification by authorized National bodies
3. Training course materials up to the European Qualification Framework (EQF) standards

1. “Hands on learning” = “learning by doing” teaching methodology

Based on the “hands on learning” teaching methodology, Install+RES training courses provide the participants with practical lessons on how to install small-scale renewable energy systems into the electrical grid and as stand-alone systems in buildings. The courses are carried out mainly in demonstration facilities and laboratories (Figure 9 and 10), where practical work is performed.



Figure 9: Install+RES training course classroom (left) and laboratory with various inverters for on- and off-grid systems (right). Source: Install+RES project

The hands on learning method enables the participants to practice how to handle RES by themselves.

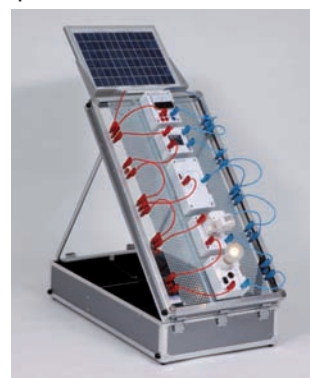
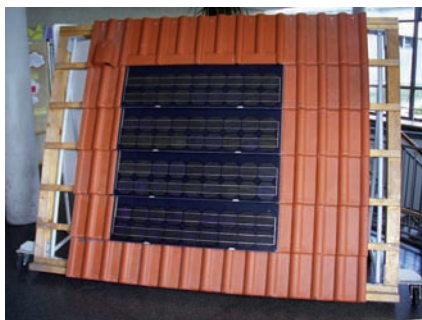


Figure 10: Roof mounting of PV modules (left), and PV suitcase (right). Source: Install+RES project

The participants also practice hybrid systems consisting of a few RES applications as well as how to build off-grid and on-grid connected systems (Figure 11).



Figure 11: Mobile demo plant for a solar thermal flat collector (left), a hybrid collector containing solar thermal and heat pump systems (right), Source: Install+RES project

In each training class there are maximum 16 participants, which allows for an interactive participation.

The courses will be held in each National language of the five participating European countries (Bulgarian, Greek, Italian, Polish and Slovenian) to ensure a more effective outcome. Training materials (e-book, DVDs, etc.) are free of charge for the participants.

2. Certification by authorized National bodies

Upon successful completion of the Install+RES training course, the participants receive the “small-scale RES installer certificate”, which is authorized by the National bodies of their country. Article 14 of the Directive 2009/28/EC states that “Member States shall ensure that certification schemes or equivalent qualification schemes become or are available by 31 December 2012 for installer of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps”⁷. The Install+RES courses provide the possibility to become a certified installer of RES and to be acknowledged by a National body.

3. European Qualification Framework (EQF)

The training courses are established following the European Qualification Framework (EQF) standards, which allow individuals and employers to better understand and compare the qualifications levels of different countries and different education and training systems⁸.

Besides, the certificate awarded by one Member States will be recognized by other Member States, which allows the certified installers to travel and work in other EU Member States. According to the 2009/28/EC Directive, the Member States may also make a list of qualified and certified installers. By this means, the installers will be able to take on job opportunities across the EU.

⁷ The European Parliament and the Council of the European Union, Directive 2009/28/EC on the promotion of the use of energy from renewable sources [EC 2009].

⁸ Agreed upon by the European institutions in 2008, the European Qualification Framework is being put in practice across Europe. It encourages countries to relate their national qualifications systems to the EQF so that all new qualifications issued from 2012 carry a reference to an appropriate EQF level. For further information on EQF please visit the website of the European Commission-Education and Training under http://ec.europa.eu/education/lifelong-learning-policy/doc44_en.htm [EC 2008]

VI. How to become a certified RES installer?

Providing an outstanding course structure, Install+RES training courses for installers of small-scale renewable energy systems (RES) offer the opportunity to become a certified:

- **Photovoltaic System Installer**
- **Solar Thermal System Installer**
- **Heat Pump System Installer**
- **Biomass System Installer**

The participant can get qualified in one or more RES applications. The courses are designed to allow flexible participation. The successful completion of all RES modules qualifies for the Certification of a Renewable Energy Systems Installer. All courses consist of a theoretical and practical component.

Becoming a qualified installer of small-scale renewable energy systems opens the door to a market which is expected to expand unimaginably in the coming years. With the Install+RES qualification courses you will not only be at the forefront as one of the few qualified installers Europe-wide but also contribute directly to its development. Install+RES training courses give installers the opportunity to:

- become a certified installer of renewable energy systems (RES) in line with the National and European Requirements
- figure out the needs of the energy market and the offered support schemes
- start reducing electricity bills in households
- ability to better guide the customers in choosing RES-installations

Training courses acknowledged by authorized National Bodies of the selected countries are already available in Bulgaria, Greece, Italy, Poland and Slovenia. The Install+RES courses are offered until April 2013.

Do not miss the opportunity to become a certified installer of the most innovative and market oriented energy technologies.

Description of the training courses

The Install+RES training course material is developed in line with the requirements of the Directive 2009/28/EC on the promotion of the use of energy from renewable resources (Article 14, Annex IV). The courses comprise

both theoretical and practical parts to ensure the participants gain the necessary skills and technical understanding to successfully install RES. The total duration of the courses depends on the technical background of each participant and on the number of certifications the participant wants to attain.

A detailed structure of the program as well as the description of the module is explained below.

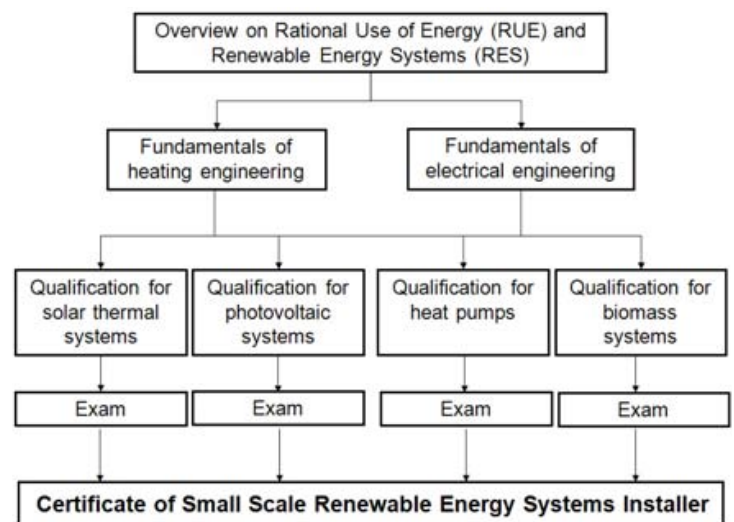


Figure 13: Structure of the Install+RES courses for installers of small-scale renewable energy systems

Summary of the training modules

Overview on Rational Use of Energy (RUE) and Renewable Energy Systems (RES)

This module provides the participants with an exhaustive overview of the energy standards in buildings, ecological labels and small-scale renewable energy systems with their current markets and potentials. The training materials are designed specifically concerning market needs, potential installers' backgrounds and the National Action Plans of potential installers' countries, in this case Bulgaria, Greece, Italy, Poland and Slovenia.

Fundamentals of heating/ Fundamentals of electrical engineering

This module aims to give the participants the basic principles of the required engineering background, which is essential to develop a comprehensive understanding of RES they will be installing. The attendance of this module depends on the technical background of each participant.

A participant with a technical background in electrical systems (e.g. an electrician), who wants to get qualified as installer of a solar thermal system, has to attend the module on fundamentals of heating engineering. A participant with a technical background in heating systems (e.g. a plumber), who wants to get qualified as installer of photovoltaic systems, has to attend the module on fundamentals of electrical engineering. A participant with a technical background in electrical systems (e.g. an electrician), who wants to get qualified as installer of a photovoltaic systems, does not have to attend the module on fundamentals of electrical engineering.

Qualification for Solar Thermal Systems and/or Photovoltaic Systems and/or Heat Pumps and/or Biomass Systems

This module allows the participant to obtain the technical skills required to properly install a solar thermal system and/or photovoltaic system and/or a heat pump and/or a biomass system. The module is carried out mainly in demonstration facilities and laboratories, where practical work is performed.

The attendance of the modules depends on the technical background of each participant. An electrician who wants to get qualified as a photovoltaic system installer has to attend *Overview on Rational Use of Energy (RUE)* and *Renewable Energy Systems (RES)* and *photovoltaic systems* modules. A plumber who wants to get qualified as PV installer has to attend *Overview on Rational Use of Energy (RUE)* and *Renewable Energy Systems (RES)*, *fundamentals of electrical engineering* and *PV systems* modules. If more than one certification is desired more qualification modules have to be attended.

Exam

The training course will be completed with an exam leading to a certification or qualification according to the requirements of the Directive 2009/28/EC on the promotion of the use of energy from renewable resources (Annex IV). The examination comprises a practical assessment of successfully installed RES (solar photovoltaic or solar thermal applications or biomass boilers or stoves or heat pumps). Upon successfully passing the exam, the participant will be certified and qualified as installer of small scale renewable energy systems in buildings. The names of the certified installers will be published on the Install+RES homepage (<http://www.resinstaller.eu>).

Who can attend the training courses?

The training course is targeting candidates with the following working experience, who have undergone, or are undergoing the following types of training:

- a) For biomass boiler and stove installers: training as plumbers, pipe fitter, heating engineer or technical sanitary and heating or cooling equipment
- b) For heat pump installers: training as plumber or refrigeration engineer and have basic electrical and plumbing skills (cutting pipe, soldering pipe joints, gluing pipe joints, lagging, sealing fittings, testing for leaks and installations of heating or cooling systems)
- c) For solar photovoltaic or solar thermal installers: training as plumber, electrician, and have plumbing, electrical and roofing skills, including knowledge of soldering pipe joints, gluing pipe joints, sealing fittings, testing for plumbing leaks, ability to connect wiring, familiar with basic roof materials, flashing and sealing methods
- d) a vocational training scheme to provide an installer with adequate skills corresponding to a three years education in the skills referred to in point a), b) or c) including both classroom and workplace learning.

Who offers the training courses?

The Install+RES training courses are offered by highly qualified trainers in Bulgaria, Greece, Italy, Poland and Slovenia.





For further questions or more information about the course schedule and participation fees please contact the partner in your country.

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VII. References

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AIE
European Association of Electrical Contractors



CRES
Centre for Renewable Energy Sources and
Saving, Greece



FIEC
European Construction Industry Federation



ALP
Academy for Teacher In-Service
Training and Staff Development,
Germany



SCV
School Centre Velenje, Slovenia



City of Munich
Department of Education and Sports
Vocational School for
Electricians and Electronics Installers
Training Centre for Solar Technology (BZS)
Germany



PK
Cracow University of Technology, Poland



ASSISTAL
Italian National Association of Plant Builders,
Italy

