



TRAINING BUILDING WORKFORCE ROADMAP

for Energy Efficiency and Renewable Energy Sources

APRIL, 2013

(FINAL DOCUMENT)

DOCUMENT PREPARED BY



IN COLLABORATION WITH



PROJECT

IEE/11/BWI/473/SI2.604354-FORESEE





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Further information

More details on BUILD UP Skills can be found at www.buildupskills.eu

More details on the IEE programme can be found at <http://ec.europa.eu/intelligentenergy>

CONTENTS

FOREWORD	1
EXECUTIVE SUMMARY	3
INTRODUCTION	5
BUILDING SECTOR.....	5
Building sector and Portuguese economy	5
Building stock.....	5
Buildings with high energy performance.....	6
USE OF ENERGY AND RENEWABLE ENERGIES IN BUILDINGS	7
ENERGY POLICY	9
National action plans for energy efficiency and renewable energy sources.....	9
Relevant legislation in the buildings sector.....	11
Scheduled activities for implementing the EPBD Recast and the RES Directives	12
EXISTING VET PROVISIONS IN THE FRAMEWORK OF THE NATIONAL QUALIFICATION SYSTEM	13
The National Qualifications System (NQS)	13
Co-ordination structures of the National Qualification System	13
Training providers of the National Qualifications System	14
The National Catalogue of Qualifications (NCQ)	15
Modalities of double-certification education and training	16
Continuing training in the framework of the National Qualifications System.....	17
QUALIFICATION NEEDS AND GAPS	17
Workforce relevant for Energy Efficiency (EE) and Renewable Energy Sources (RES)	17
Skills and qualification needs.....	19
Skills gaps	20
BARRIERS	24
PRIORITY MEASURES.....	25
STRATEGY OVERVIEW	25
STRUCTURAL ACTIONS.....	26
Regulation process of some activities/professions in the context of the Regulation System for Access to Professions.....	26
Initiatives in the National Qualification System framework.....	27
Measures of partial certification.....	28

OPERATIONAL ACTIONS	28
Occupations related to RES	29
Occupations related to Energy Systems (other than RES)	29
Occupations related to building envelope	29
SUPPORTING ACTIONS.....	30
Measures of promotion to access training.....	30
Information campaign about the importance of low energy construction.....	30
ACTION PLAN.....	31
STRUCTURAL (M.ST.)	31
OPERATIONAL (M.OP.).....	32
SUPPORTING (M.SP.)	35
CONCLUSIONS	37
AUTHORS/CONTRIBUTORS	39
Authors	39
Contributors.....	39
REFERENCES.....	41

FOREWORD

The 2014-2020 roadmap for training building sector workers for the energy efficiency (EE) and renewable energy sources (RES) appears in the framework of BUILD-UP SKILLS PORTUGAL, a 18 months project financed by the Intelligent Energy Europe program¹, aiming at:



- Identify measures to overcome barriers and skill gaps in the various professions to meet the 2020 targets in the building sector;
- Embed training on intelligent energy solutions through changes in the mainstream curricula and practice;
- Suggest the necessary measures to ensure that the added value of a more highly qualified workforce is recognized and the use of qualified workers is motivated or made obligatory.

The national roadmap is the main deliverable of this project and consists of:

- ➔ Presenting the **general strategy** for fulfilling the training needs of the building sector craftsmen or installers in order to reach the 2020 energy targets defined in the national action plans for energy efficiency and renewable energy sources (PNAEE and PNAER);
- ➔ Pointing out the **key/priority measures** for the building sector craftsmen or installers occupations considered relevant and essential to achieve the national goals;
- ➔ Delineating the **action plan**, a set of recommendations for the action, focusing on the specific target to be trained or other structural and promotional actions.

This document outlines the point of view of the entities of the project consortia – National Laboratory for Energy and Geology, I.P. (LNEG), Portuguese Energy Agency (ADENE), Directorate General for Energy and Geology (DGEG) and National Agency for Qualification and Vocational Education and Training (ANQEP) – complemented by the Institute of Construction and Property, I.P. (InCi) and the contacts established with multiple entities representing vocational training centers for building sector, national entrepreneurial or industrial associations, tradesman and

¹ IEE/11/BWI/473/SI2.604354-FORESEE

professional associations and other public or certifying entities in the building sector. Despite the fact that all the project entities are dependent from the Ministry of Economy and Employment and Ministry of Education and Science, this document does *not* constitute an official political point of view or strategy of the Portuguese government for the timeline here considered.

Furthermore, the action plan describes the required measures, in terms of operational training, to reach the 2020 energy goals established by the Portuguese government.

For those entities institutionally apart from the Ministry of Economy and Employment, being a signatory of the present document does *not* necessarily mean the full support of the national action plans for energy efficiency and renewable energy sources (PNAEE and PNAER) or other building regulation that come from the transposition of European Directives related to Energy Efficiency and Renewable Energy Sources.

Supported by:

National Laboratory for Energy and Geology, I.P. (LNEG)

Directorate General for Energy and Geology (DGEG)

Portuguese Energy Agency (ADENE)

National Agency for Qualification and Vocational Education and Training (ANQEP)

EXECUTIVE SUMMARY

BUILD-UP SKILLS-Portugal focused on the evaluation of the workers in building sector, specifically craftsmen and installers, in terms of their skills in energy efficiency (EE) and renewable energy sources (RES).

Portugal has established, as in other countries of EU, an energy policy with two action axis: i) increase the energy efficiency by reducing the final energy use and ii) increase the RES share in the total primary energy. These goals have been quantified in the revised PNAEE and PNAER².

Defining the route to achieve the objectives pursued for 2020 is crucial. The recast of the Energy Performance of Buildings Directive (2010/31/EU) drives countries to tighten the building energy requirements and requests, by 2020, new nearly Zero-Energy Buildings. Energy goals are ambitious. Despite the building sector activity is decreasing, the workforce still does not have the appropriate skills. Therefore, training for EE and RES becomes necessary and urgent.

In Portugal, the current workforce which skills are related to EE and RES is estimated to be in the range of 55 to 65 thousand. From those, as well as from others coming from first employment or unemployment, a total of 30.3 to 44.6 thousand should still be trained.

This roadmap identified, in order to accomplish the Renewable Energies Directive (2009/28/EC), the need to have specific training in the following technologies: photovoltaic, solar thermal, biomass boilers and stoves, heat pumps and shallow geothermal. Regarding building envelope and other energy systems, with the aim of promoting the energy efficiency in buildings energy use, the focus goes to windows installers, thermal insulation workers (including bricklayers), HVAC and boilers installers, lighting systems electricians, energy management and buildings operation technicians.

The action plan for the period between 2014-2020 consists of a set of **structural**, **operational** and **supporting** measures. The main target of the operational action plan stands on the current workforce relevant for EE and RES (67 percent of the total to be trained). However, requalification

² Approved by Cabinet Resolution from February, 28th, 2013, still unpublished.

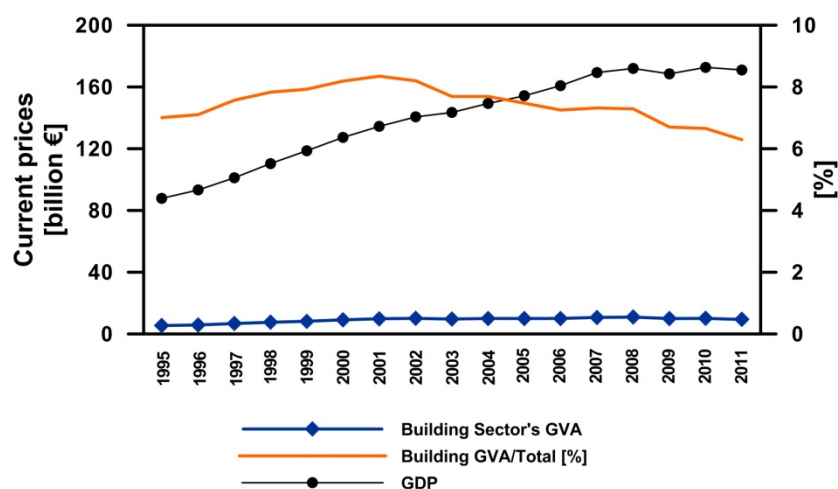
programs for unemployed (around 13 percent of the total to be trained) are also a leading issue to be considered in the EE and RES training strategy. The investment cost for the set of operational measures is in the range of 24-45 million Euros.

INTRODUCTION

BUILDING SECTOR

Building sector and Portuguese economy

The Portuguese economic crisis has caused a slow-down of the GDP (Gross Domestic Product). After four consecutive years of annual growth, 2008 was marked by a zero variation, followed by a 2.5 percent GDP drop in 2009. Economic activity recovered slightly in 2010, with a 1.4 percent growth, but in 2011 it decreased again (Figure 1).



Source: INE [National Institute of Statistics], Contas Nacionais.

Figure 1 – Variation of the Gross Valued Added in the Building Sector versus the Gross Domestic Product.

Since 2001, the importance of the Building sector for the Portuguese economy has decreased; in 2009, this sector's production represented 9.6 percent of national production. Relatively to the GVA (Gross Value Added) of this business sector, 2011 data show that it represents 6.3 percent of total GVA, which is in line with the European average (6.5 percent in 2008).

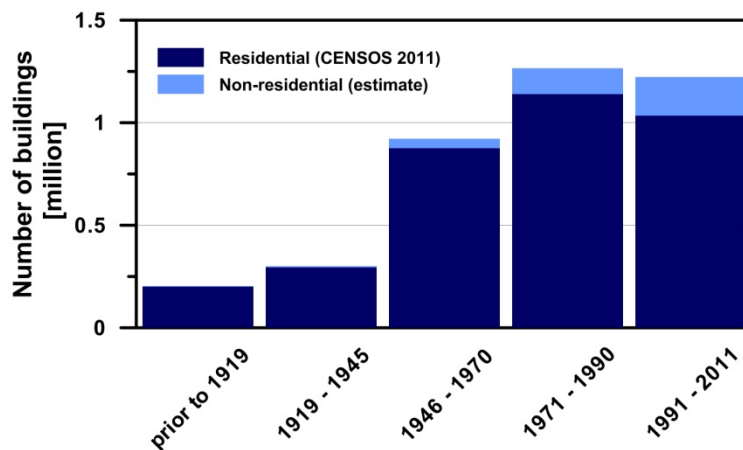
Building stock

In Portugal, according to a study made by the Buildings Performance Institute Europe (BPIE), the built-up area amounts to approximately 400 million square meters. Residential buildings represent roughly 75 percent, a value close to the European average.

Portuguese 2011 Census (CENSOS 2011) listed more than 3.5 million buildings totally or partially allocated to housing. The ratio of single-dwelling buildings to the remainder (multi-family) is 87 percent. Nevertheless, it represents the share of single-family homes, insofar as there may be buildings only with one dwelling, in which the other

households have been allocated to different activities, namely economic ones. The residential sector is certainly the largest segment, in terms of both number of buildings and built-up area, although no nationwide statistics are available for the non-residential building sector. Therefore, the total number of buildings constructed between 1999 and 2010 that were not targeted for housing purposes, represent an accumulated total of 73,887 and 15.4 percent of all buildings constructed in that decade (479,431).

Distribution of the residential stock, according to the last CENSOS, among different periods in the last 100 years is shown in Figure 2. It is noteworthy that one million (1.034 million) residential buildings were constructed in the last two decades. It is possible to estimate that approximately 180,000 non-residential buildings were constructed over the same period and the total universe of this type of buildings, assuming that the percentage of non-residential buildings has been growing in the last decades, is 300-400 thousand.



Source: CENSOS 2011 and estimate based on Statistics on Completed Works, INE (2011).

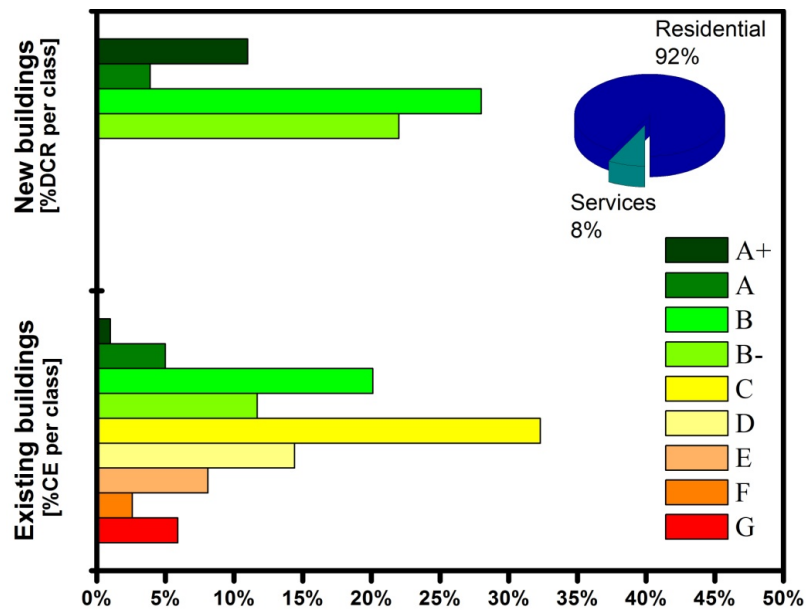
Figure 2 – Buildings by time of construction.

Buildings with high energy performance

The database of National System for the Energy and Indoor Air Quality Certification of Buildings (SCE) provides monthly-updated summaries on the Energy Performance Certificates (CE) and Statements of Conformity (DCR), which apply to constructed buildings and buildings at the design phase, respectively.

Currently there are approximately 500 thousand buildings certified under the Energy Certification System (SCE), of which 100 thousand are at the design phase and the remaining 400 thousand are existing and recently-built property for which a DCR has already been issued. Buildings for

residential purposes still lead the way, with 92 percent of the certificates issued under the SCE.



Source: ADENE.

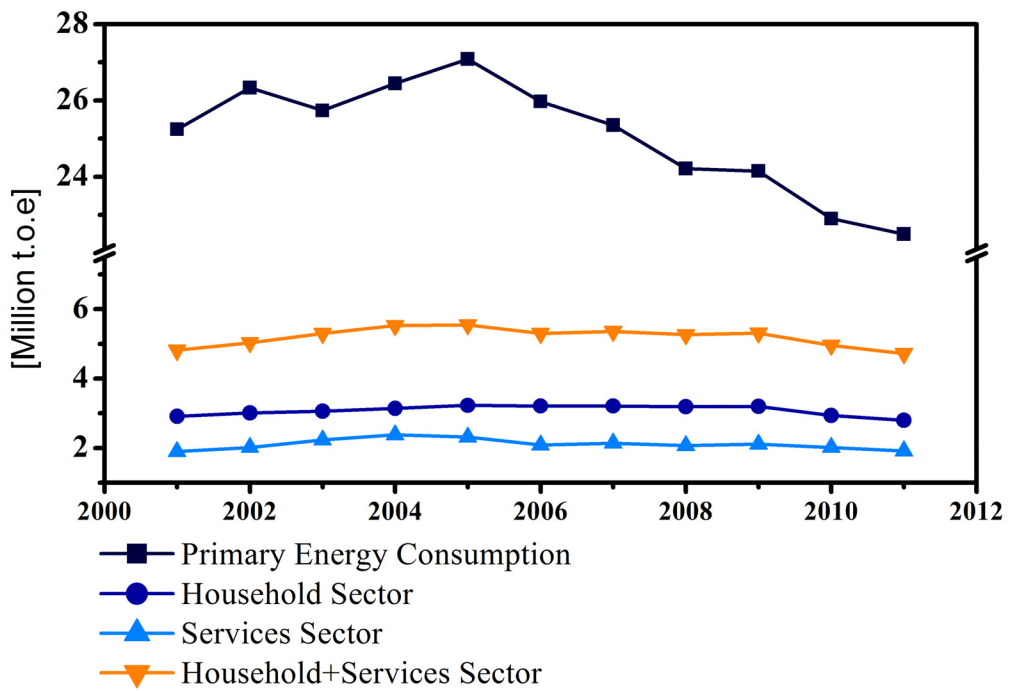
Figure 3 – Number of Energy Performance Certificates/Statements of Conformity issued

Energy Performance Certificates (CE) issued for existing buildings of the residential and services categories, with class A and A+, have the following distribution: 18,675 and 392, representing approximately 5% and 1% of the full range of energy classes within the two categories. Regarding the percentage distribution per type of building, 90 and 10 percent correspond roughly 460 and 40 thousand certified buildings, respectively.

Existing buildings have a low level of energy efficiency, when compared to new ones. In addition to traditional renovation, existing buildings must have a high potential for improving their energy efficiency once the energy efficiency improvement measures have been adopted. Requirements imposed by the thermal regulation of buildings currently mandatory led to considerable improvement of energy efficiency in buildings, although there is still room for further improvement measures.

USE OF ENERGY AND RENEWABLE ENERGIES IN BUILDINGS

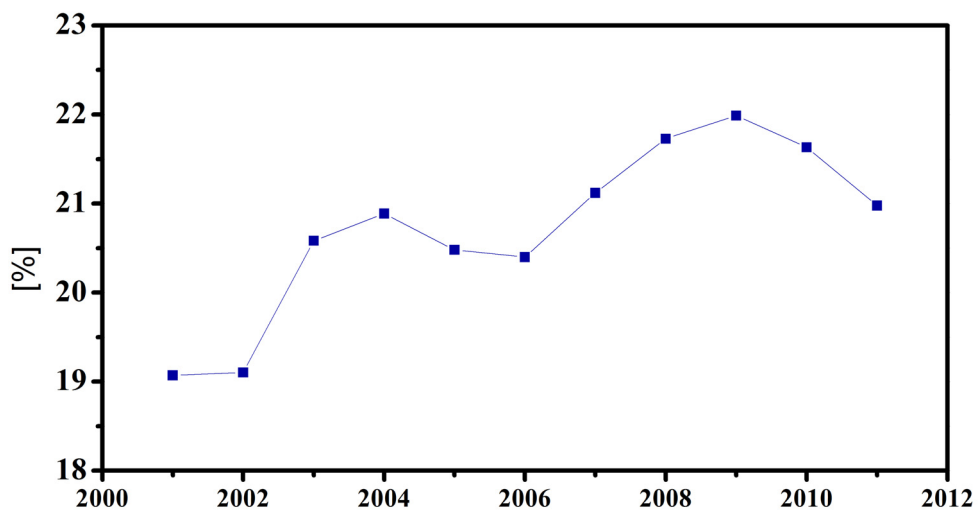
End-use energy consumption in buildings (household and services) is shown in Figure 4 for the last ten years, for which statistics are available (national energy balance). The energy consumption in households and services, once deducted of road fuel consumption in the services sector, corresponds to energy consumption in buildings. Figure 4 also shows the evolution of primary energy consumption in the same period.



Source: DGEG

Figure 4 – Consumption of end-use energy in buildings (households and services) and primary energy consumption.

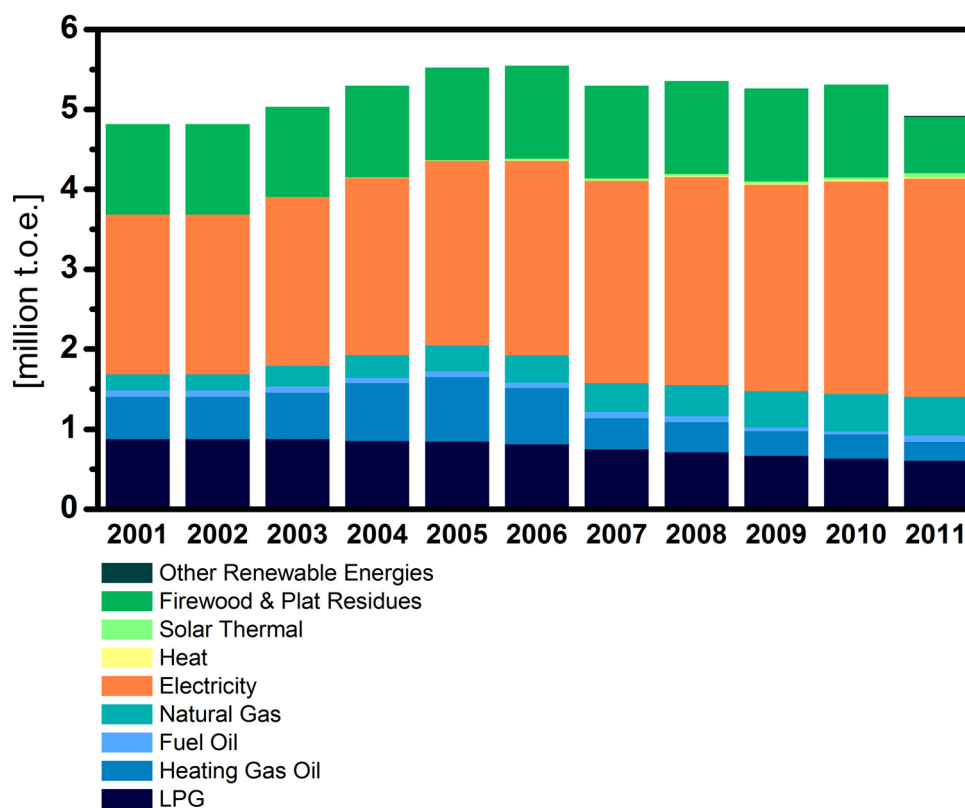
As shown, energy consumption in buildings behaves similarly to primary energy consumption, although the relative weight of this sector has moderately grown in recent years, as evidenced by Figure 5.



Source: DGEG

Figure 5 – Relative weight of energy consumption in buildings vis-à-vis primary energy consumption.

The main source of energy used in buildings, as regards consumption by energy source (Figure 6), is electricity, followed by LPG (liquefied petroleum gasses) and firewood & plant residues. As shown, consumption of heating gas oil, fuel oil and LPG has dropped due to the growing penetration of natural gas, increasingly used in recent years.



Source: DGEG

Figure 6 – Evolution of end-use energy consumption in buildings (households and services), by energy source.

Figure 6 also shows an increased use of solar thermal energy, which only began to be recorded for energy balance purposes in 2005.

It should be noted that the amount identified for firewood & plant residues has been estimated as a function of studies based on household surveys. The last survey, dated 2010, made it possible to determine that the use of firewood & plant residues decreased significantly versus the 1986 study. Currently RES share in buildings energy use represents 18 percent.

ENERGY POLICY

National action plans for energy efficiency and renewable energy sources

The national action plans for energy efficiency and renewable energy sources (PNAEE and PNAER, respectively)³, were approved but still unpublished and follow the same line of action as those approved in 2008 and 2009⁴, updated to the current macroeconomic context conditions, mainly the funding restrictions and the economy deceleration. In the last

³ “Linhas estratégicas para a revisão dos Planos Nacionais de Ação para as Energias Renováveis e Eficiência Energética”, Direção Geral de Energia e Geologia (DGEG), June 2012.

⁴ Cabinet Resolution no. 80/2008, Plano Nacional de Acção para a Eficiência Energética (PNAEE), Portugal Eficiência 2015. Plano Nacional de Acção para as Energias Renováveis (PNAER), 2009.

decade (2000-2010) the primary energy consumption, as well as the final energy decreased⁵, while the renewable energy supply increased⁶.

The revised national action plans, PNAER and PNAEE, establish the following targets for the next years:

- **For 2016**, a decrease of 1.5 Mtoe in final energy, compared with the average final energy between 2001 and 2005;
- **For 2020**, a decrease of 8 Mtoe in primary energy, compared with the energy demand projection of PRIMES model from European Commission.

The initial PNAEE and PNAER projected that the building sector, which includes state, residential and services buildings, contributes with 26% for the target of final energy decrease (about 470 ktoe). According to the implementation report of 2010, an energy decrease of 220 ktoe is already achieved, leveraged by the following measures - Home & Office Renewal, Energy Efficiency System in Buildings, Renewable in the hour and Solar Thermal, which initially aimed at:

- Program of incentives for sustainable urban rehabilitation, with the purpose of achieving 1 in 15 homes with optimized energy class (equal or higher than B-);
- Program to renew 1 million large electrical appliances;
- Replacement of 5 million lamps with CFL;
- 75 thousand electricity-producing homes (165MW of installed power);
- 1 in 15 buildings with Solar Hot Water.

The revised PNAEE and PNAER reinforce most of the above measures, namely by promoting, until 2020:

- Installation of energy efficient windows;
- Application of thermal insulation in external walls and roofs;
- Installation of heat recovery systems in fireplaces;
- Improved construction of new dwellings and new service area;
- Public buildings with energy performance certification;
- Installation of solar collectors in residential buildings, service buildings and public buildings.
- Installation of renewable electricity generation systems (wind and PV) in residential and services buildings (micro and mini generation program).

⁵ Average annual decrease of 1% for primary energy, and 0.2% for final energy.

⁶ Average annual growth of 19%.

Relevant legislation in the buildings sector

The National System for the Energy and Indoor Air Quality Certification of Buildings (SCE), which is intended to provide significant energy savings, is one of three foundations on which the legislation for the thermal quality of buildings in Portugal is based. The SCE, together with the technical regulations applicable in this framework to residential buildings (RCCTE⁷) and services buildings (RSECE⁸), sets out the rules and methods required to monitor the actual enforcement of such regulations to new buildings, as well as to the already existing buildings stock at a later stage.

The RCCTE establishes quality requirements applicable to new residential buildings and small services with HVAC systems of thermal power below 25 kW, namely regarding the characteristics of the envelope (walls, glazing, pavements and roofs), in order to prevent thermal losses and control surplus solar gains.

This regulation imposes maximum energy consumption levels for climatization and domestic hot water production, clearly encouraging the use of efficient systems and lower-impact energy sources in terms of primary energy consumption. This regulation also determines the mandatory installation of solar collectors (for suitable solar orientation) and evaluates the use of other renewable energy sources while rating the energy performance of the building.

The RSECE sets out a series of requirements applicable to service and residential buildings equipped with HVAC systems above 25 kW of thermal power, which, in addition to defining the quality of the envelope and restricting energy consumption, also regulate the efficiency and maintenance of HVAC systems in buildings and determine that mandatory audits be periodically carry out in large services buildings. This regulation also covers the indoor air quality, including requirements determining the renewal air rates in indoor areas and the maximum concentration of the main pollutants.

Regional Decree-Law no. 1/2008/M, of January 11th, adapts SCE, RSECE and RCCTE to the Autonomous Region of Madeira. In turn Regional Decree-Law no. 16/2009/A, of October 13th, adapts SCE to the Autonomous Region of the Azores.

⁷ Regulamento das Características de Comportamento Térmico dos Edifícios, approved by Decree-Law no. 80/2006 of the 4 April.

⁸ Regulamento dos Sistemas Energéticos de Climatização em Edifícios, approved by Decree-Law no. 79/2006 of the 4 April.

Decree-Law no. 118-A/2010, of November 25th, established the legal system for generating power by means of small power plants called micro-generation units, with a grid-connecting capacity of up to 5.75 kW in the general system and up to 3.68kW in the subsidized system. In order to benefit from the subsidized selling rates, the promoters of this measure must install solar thermal systems or other equivalent systems using renewable energy sources.

Decree-Law no. 34/2011, of March 8th, established the legal system applicable to power generation by means of small power plants called mini-generation units, with a grid-connecting capacity of up to 250 kW.

Scheduled activities for implementing the EPBD Recast and the RES Directives

Regarding the activities scheduled for implementing the EPDB Recast Directive, Portugal is currently amending the regulations of the National System for the Energy and Indoor Air Quality Certification of Buildings (SCE). This review will include the adoption of more demanding rating criteria in the framework of Energy Performance Certification.

Activities scheduled in the Renewable Energies Directive are programmed on PNAER. The most relevant for the buildings sector are the Renewables on Spot programme for the electricity area and the investment in decentralized generation systems either for DHW production or climatization, using solar thermal systems, biomass-fed boilers and heat pumps.

It should be noted that district heating systems, in view of Portugal's climate, would have very low levels of utilization and would not be economically viable.

Reference should also be made to the fact that Portugal is involved in a joint European action for implementing the Renewable Energies Directive (2009/28/EC) called CA-RES (www.ca-res.eu), which addresses the thematic of Energy in Buildings, issues related to the Certification of installers of Renewable Energy systems and also issues related to general information on Renewable Energy Sources and their benefits. Portugal's involvement in CA-RES is closely associated with the Build-up Skills initiative.

EXISTING VET PROVISIONS IN THE FRAMEWORK OF THE NATIONAL QUALIFICATION SYSTEM

The National Qualifications System (NQS)

The NQS aims to ensure that training and learning provided for personal development purposes and for modernizing the corporate sector and the economy are relevant. Acquired skills are certified by completing a full training pathway in the framework of an initial training modality, or by completing a number of short-duration training units (UFCD) of the National Catalogue of Qualifications (NCQ) standards. These units can be credited for subsequently seeking qualification.

All training actions in the framework of the NQS, if not NCQ-specified, grant a vocational training certificate that proves the successful completion of such training, allowing the recognition of the acquired competences. NQS also provides an individual skills handbook for recording all competences acquired in a life time, not only those mentioned on the NCQ but also all other training, even if provided by a non-certified training entity.

Co-ordination structures of the National Qualification System

The NQS is coordinated by the cabinet members responsible for the vocational training and education areas. The National Agency for Qualification and Vocational Education and Training (ANQEP) was created in the framework of the NQS. ANQEP is a government body jointly supervised by the Ministry of the Economy and Employment and the Ministry of Education and Science, competent for coordinating the structure network and for following up, monitoring, evaluating and regulating the system, in close co-operation with the other member institutions of the NQS.

ANQEP set up the Sector Councils for Qualification with the aim of updating the NCQ, which is the strategic qualifications management instrument of the NQS. These councils are technical-consultative groups in charge of permanently identifying the updating needs of qualifications included in the NCQ with a view to matching training with technological progress and sector-required competences, be it initial training or lifelong learning. Sector Councils for Qualification are composed of experts appointed by the ministry responsible for the respective sector of activity, trade unions and employers' organizations representing the respective sectors of activity, reference companies, training entities with high-level expertise in the sector or region and independent experts.

Training providers of the National Qualifications System

The network of training providers of the NQS are the basic and secondary schools, the private teaching establishments with recognized pedagogic plans or recognized public interest, vocational schools, centers for vocational training and vocational rehabilitation and private-sector entities with certified training structures, under the ministries responsible for vocational education and training, and the training entities attached to other ministries or other legal persons governed by public law.

In the concrete case of the building and energy sectors, special reference should be made to a few more relevant training providers of the National Qualifications System, namely:

- 1) Centers for Training on Joint Management, of the Institute for Employment and Vocational Training's network, for the building sector:
 - CICCOPN – Centre for Vocational Training of the Building and Public Works Industry of Northern Portugal
 - CENFIC – Centre for Vocational Training of the Building and Public Works Industry of Southern Portugal
- 2) Centers for Training on Joint Management of the Institute for Employment and Vocational Training's (IEFP) network, as well as the training centers specific to the sectors of electronics, energy and mechanical engineering:
 - CINEL – Vocational Training Centre of the Electronics, Energy, Telecommunications and Information Technologies Industry
 - APIEF – Vocational Training Centre for the Thermal, Energy and Environment Industry
 - CENFIM – Vocational Training Centre of the Metalwork and Mechanical Engineering Industry
- 3) Public or private-owned educational establishments, licensed to teach courses in the fields of education and training on building, energy and electricity:
 - Basic and Secondary Schools of the public network
 - Private-owned Vocational Schools supervised by the Ministry of Education
- 4) Private training providers certified by the Directorate General for Employment and Labour Relations (DGERT) in the training areas relevant to the building & energy sector. These are training providers evaluated by DGERT, with minimum proven conditions in terms of their quality references as organizers of training activities, regarding their installed capacity, resource-wise, their practices inherent to the processes of training development and the results achieved.

The National Catalogue of Qualifications (NCQ)

The National Catalogue of Qualifications (NCQ) is a strategic management instrument for non-higher qualifications, including all essential standards required to better match the training offer to the needs of companies, the labor market and citizens. Accordingly, all elements of the NCQ are permanently updated with the support of the sector-specific council for qualification, by including, excluding or changing qualifications as a function of the current and emerging needs of companies, economic sectors and individuals.

Qualifications incorporated in the NCQ have been structured according to the levels of qualification defined by the National Qualifications Framework (NQF). NQF adopts the principles of the European Qualifications Framework (EQF) relatively to the description of qualifications in terms of learning outcomes, in accordance with the descriptors associated with each qualification level, promoting qualification comparability as a function of its profile and not as a function of contents or training processes.

Obtaining qualification means having the competences acquisition recognized and certified, in conformity with the standards purpose fully established. Such standards are the elements represented in Figure 7.

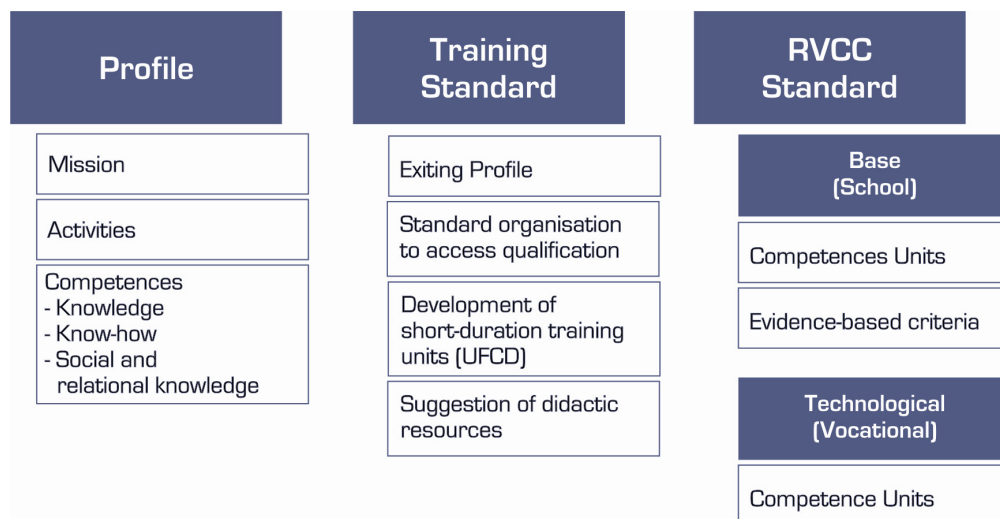


Figure 7 – Qualification standards of National Catalogue of Qualifications

Modalities of double-certification education and training

NCQ-incorporated qualifications are double-certification qualifications, meaning that they recognize a person's competences to develop one or more professional activities and they grant a schooling degree in the form of a diploma.

Qualifications can be accessed by way of a number of double-certification training modalities, targeted at either young people or adults, structured with reference to the NCQ qualification standards.

Taking this into account, the Short-Duration Training Units (UFCD) scheduled for each training standard of NCQ, structure the double-certification training offers, including the certified module-based training actions enabling a gradual and flexible double certification. They can also be used for continuing training.

Short-duration training unit (UFCD)

A learning unit, which can be autonomously certified and integrated into one or more training standards referred to in the National Qualifications Catalogue, making it possible to acquire the certified competences.

Modalities of double-certification training targeted at young people

Vocational Courses – level 4 of qualification

Secondary-level education courses, scheduled for the initial training of young people, promoting their integration into the labour market and enabling them to continue their studies. *(Ordinance no. 74-A/2013)*

Apprenticeship Courses – level 4 of qualification

Initial vocational training courses for young people, work-linked, promoting their integration into the labour market and enabling them to continue studies. Their completion grants the secondary school degree. *(Ordinance no. 1497/2008)*

Modalities of double-certification training targeted at adults

Education and Training Courses for adults (EFA) – level 2 and level 4 of qualification

Courses for individuals with 18 years-old, or more, unqualified or without appropriate qualification, for the purpose of integration, re-integration and progress in the labour market, who have not finished basic education or secondary education. *(Ordinance no. 283/2011)*

Certified Modular Training

Training developed by attending any short-duration training units (UFCD) that are part of base training and/or the technological training of any NCQ standard, of level 2 or level 4 of qualification, targeted at adults in the framework of continuing training. *(Ordinance no. 283/2011)*

Modalities of double-certification education and training, targeted at the non-university post-secondary level

Technological specialisation courses – level 5 of qualification

Courses targeting a specialised technical training for the purpose of integration, re-integration and progress in the labour market, for individuals who have finished or hold a secondary education degree, or higher, enabling them to continue their studies. *(Decree-Law no. 88/2006)*

Continuing training in the framework of the National Qualifications System

The NQS defines continuing training as any education & training activity developed after leaving the schooling system, or after joining the labor force, which enables the individual to improve his/her professional and relational competences with a view of developing one or more professional activities, better adapting to technological and organizational change and strengthening his/her employability.

The short duration training units (UFCD) of the NCQ are the basis for double-certification continuing training, carried out by certified training providers, vocational training centers of the IEFP network or teaching establishments, constituting the entity network of the NQS. These entities grant a qualifications certificate, proving that such UFCDs were successfully completed, contributing to obtain a qualification certified by a diploma.

NQS also determines that a vocational training certificate governed by law is issued for all certified training activities not included in the NCQ, when such activities are developed by an entity certified for this purpose, or by teaching establishments recognized by the competent ministry – that is to say, training entities belonging to the NQS.

QUALIFICATION NEEDS AND GAPS

Workforce relevant for Energy Efficiency (EE) and Renewable Energy Sources (RES)

The analysis of the occupations⁹ resulted in the identification of which of them are relevant to the achievement of 2020 energy targets.

Relatively to the number of workers for the identified occupations, it should be pointed out that its update is unfeasible, due to statistical national constraints. In fact, the most updated data reports to 2009 (Table 1), according to 1994 occupation classification, which does not contemplate some of the new occupations.

⁹ Base group analysis according to ISCO classification and CPP2010.

A total of almost 80,000 workers represents 17 percent of the building sector workforce in the same year.

Table 1 – Employed persons in the building sector with EE and RES relevant occupations¹⁰, in 2009.

OCCUPATION	2009
Building Civil Engineering Architectural Technician	2,938
Electrical installation technician	962
Cold Storage & Climatisation Technician	747
Maintenance man (electricity)	104
Electrical network technician	29
Chief draughtsman	290
Draughtsman	634
Mason	41,408
Construction supervisor	8,655
Trim carpenter	5,324
Floor and wall tiler	1,416
Floor coverer	1,698
Plasterer	3,594
Insulator	960
Glazier	121
Plumber	5,596
Pipe fitter	405
Electrical fitter of lifts and similar equipment	1,253
Electrical fitter of HVAC equipment	603
Electrician-assembler of low voltage installations	2,219
TOTAL	78683

Source: Strategy and Planning Office of the Ministry of the Economy and Employment, Permanent Staff Inquiry, 2009.

However, employment growth in the construction sector has followed the trend of decline that occurs at national level and, in 2011, registered a decrease of 8.7 percent of the employed population, which corresponds, from 2010 to 2011, to the loss of 42100 workers. This decline is also reflected in the percentage of the population employed in the construction sector from the total employed population in Portugal, reaching 9.1 percent in 2011. In reality, this is a trend that has been following the evolution of employment in this sector for the last decade. The registered unemployed (looking for a new job), by economic activity, shows that in the construction sector, the growth between 2009 and 2011 was 21 percent, reacting nearly 70,000 subscribers, representing 14.4 percent of the national total.

A further analysis of the unemployment shows that '*non qualified workers in mining, construction and manufacturing operators*' and '*related workers on mining and construction*' are within the top five categories of applicants, representing 18 percent of the total.

¹⁰ 1994 National classification.

Applying the same unemployed rate of the construction sector, to the EE and RES workforce, one would expect that the current workforce is in the range of 55,000 to 65,000.

In summary, by increasing unemployment and reducing job offers, we can conclude that the mismatch between job demand and job supply have been increasing in the last years. This reinforces the importance and need for better and more qualified employment in the construction sector.

Skills and qualification needs

National action plans for EE and RES point out a set of relevant skills in order to achieve the 2020 energy targets, namely building workers specialized on:

- Windows installation;
- Thermal insulation;
- Thermal solar collectors installation/maintenance;
- Photovoltaic solar panels and wind installation/maintenance;
- Biomass systems installation/maintenance;
- Shallow geothermal installation/maintenance;
- HVAC installation/maintenance;
- Heat pumps installation/maintenance;
- Natural and mechanical ventilation;
- Lighting systems;
- Boilers installation/maintenance;
- Management/operation of energy systems.

Table 2 – Skills needs of relevant occupations for achieving 2020 energy targets.

ACTION LINE	OCCUPATIONS	TARGET	
		Lowscenario	High scenario
Renewables for electricity	PV and Wind Installers	500	700
Renewables for heating and cooling	Solar Thermal Installers	8 000	13 000
	Installers of Biomass Boilers and Stoves	3000	5000
	Heat Pumps Installers	1000	2000
	Shallow Geothermal Installers	50	100
Energy systems (other than RES)	HVAC installers	10 700	11 500
	Lighting	1400	2100
	Boilers installers	3000	5000
	Energy management & buildings operation	1100	2000
Building envelope	Windows installers	1000	2000
	Bricklayer and insulation workers	1450	3000
TOTAL		31 200	46 400

Table 2 presents an estimative of the total skilled workers needed by occupation, in the period between 2014-2020, to accomplish the Portuguese energy targets for 2020, according to the strategies defined by PNAEE and PNAER, as well as the requirements that come from the building energy regulations. It is noteworthy that some of those skills can be acquired by the same worker, so that the target group can be lower than those here presented.

From the total of 31.2 to 46.4 thousand workers, it is further estimated that a significant parcel, depending on the occupation, will come from the current workforce after training (70 percent). The remaining are young people that have completed the upgraded/existing training programmes or re-skilling unemployed workers.

Skills gaps

Table 3 is the result of a crossing exercise of the occupations previously identified, with the current national qualifications (National Qualification Framework, levels 2 and 4), pointing out shortly what skills upgrades are required.

Table 3 – Skills gaps of relevant occupation for achieving 2020 energy targets.

OCCUPATION	QUALIFICATION	SKILLS UPGRADE
Photovoltaic systems installer	Photovoltaic systems installer	Upgrade from electrical technician
Solar thermal installer	Solar thermal installer	Upgrade from plumber, Integration with biomass installer to assign both qualifications
Biomass installer	Biomass installer	Upgrade from plumber, Integration with solar thermal installer to assign both qualifications
Plumber	Plumber	Enable an upgrade for solar thermal installer and biomass installer
Electrical engineering technicians	Electrical technician	Enable an upgrade for photovoltaic systems installer
Included in physical and engineering science technicians not elsewhere classified.	Gas technician	Enable an upgrade for solar thermal installer and biomass. Reinforcement of skills/ knowledge related to the basic notions of energy, energy production/consumption, energy efficiency and renewable energy sources.
Air conditioning and refrigeration mechanics	Cold Storage and Climatization Technician/ HVAC Systems Technician	Enable an upgrade for solar thermal installer and biomass. Reinforcement of skills/ knowledge related to the basic notions of energy, energy production/consumption, energy efficiency and renewable energy sources.
Draughtspersons	HVAC Systems Designer	Enable an upgrade for solar thermal installer and biomass.
Building and related electricians	Electrical Installation Electrician-Assembler	Enable an upgrade for wind and photovoltaic systems installer.
Pipe fitter	NO QUALIFICATION ¹¹	Energy efficiency related to mechanical ventilation
Bricklayers	Bricklayers	Applying thermal insulation and correcting thermal bridges
Carpenters and joiners	Trim carpenter	Windows installer other than wood frames
Roofers	NO QUALIFICATION	
Floor layers and tile setters	Floor layers and tile setters	Applying thermal insulation
Plasterers	NO QUALIFICATION	
Insulation workers	NO QUALIFICATION	
Glaziers	NO QUALIFICATION	

¹¹ “No qualification” means that there is no specific qualification program in the National Qualification System.

Construction supervisors	Construction supervisors	General approach of energy efficiency in construction
Draughtspersons	Draughtspersons	General approach of energy efficiency in construction
Civil engineering technicians	Building civil engineering architectural technician	General approach of energy efficiency in construction

Electrical renewable systems

The techniques of electricity are essential to the proper installation of photovoltaic or wind systems, which is a cornerstone for training installers of these technologies. Taking into account that electrical technicians have those skills, it would be possible to undertake only specific short duration training units (UFCD) for the installation of renewable power generation (solar photovoltaic and wind systems), in order to provide them those skills.

Thermal production from renewable energy systems

For the purposes of domestic hot water (DHW) and buildings space heating, solar thermal systems or boilers that use solid, liquid or gas biomass as fuel can be used. On the basis of these systems installation and maintenance are plumbing techniques, such as welding of pipes of various materials, as well as the connection of various equipments with the networks of hot and cold water and central heating of buildings. Once that plumbers have those skills, it would be possible, in order to give them those qualifications, to undertake only specific UFCD dealing with installation of solar thermal and biomass, in order to give them those skills.

HVAC systems, boilers and other gas equipments

Taking into account the main skills of the group of workers referred above, it would be possible to undertake only specific UFCD with the reinforcement of skills/knowledge related to the basic notions of energy, energy production/consumption, energy efficiency and renewable energy sources.

Other electrical equipments

Assuming that Electricians and Electrical Mechanics and Fitters have the above referred skills, it would be feasible to undertake only specific UFCD for the installation of renewable power generation (wind and solar photovoltaic systems), in order to provide them those skills.

Building construction

Due to the fact that bricklayer skills are strongly related to the external envelope, a qualification upgrade is required in order to include the

application of thermal insulation techniques, as well as thermal bridges correction. A general upgrade on thermal insulation is required also for paving floor layers and tile setters.

Moreover, currently carpenter skills only focus in wood materials. Therefore, in relation to windows and doors installation, which are important elements for energy efficiency performance, there are two options:

1. Upgrade carpenter qualification to include specific skills on installation of other materials for windows frames,
2. Create a windows installer partial certification.

In what concerns the construction supervisor, draughts persons and civil engineering technicians, a general approach, common to other qualifications, should be introduced in the qualification skills, namely on thermal insulation, windows, rehabilitation techniques, new components, new façades elements, solar passive systems and shading devices.

Other gaps

- Training provided usually has a very extensive theoretical component neglecting practical aspects, especially for younger professionals;
- Need to revise the programmatic contents to include the concept of energy efficiency and renewable energy sources;
- Improvement of training manuals.

BARRIERS

To identify the main barriers, related to the qualification of building workers, meetings were held with several stakeholders, through a constructive exchange of views.

Regarding the training offer, it was pointed out that:

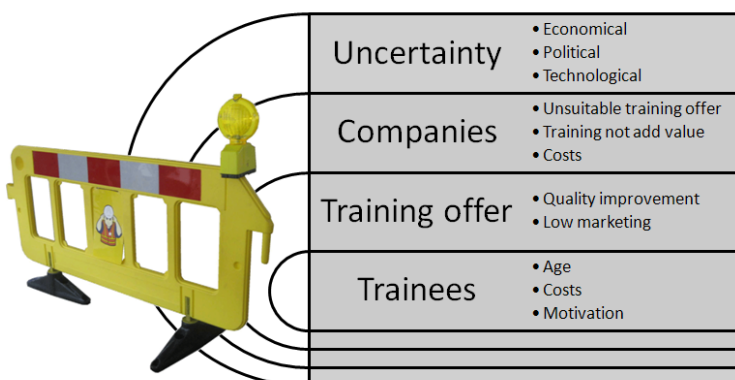
- The training offer exists but sometimes is not adequate to the company's requests;
- Difficult to motivate companies due to the **costs** involved;
- **Quality** of trainers needs improvements;
- Better **marketing**.

Besides the aspects mentioned above, other aspects inherent to the potential **trainees and companies** point of view should be highlighted:

- Lack of **motivation** due to **age** barrier;
- An investment in training is not always a driver of competition among companies and it is not regarded as advantageous.

The **uncertainty** about the evolution of some social-economic and political issues was mentioned as critical for the development of the qualifications of the workforce:

- The evolution of the **economic** situation: workforce, building stock, fuel and electricity prices;
- Public investment, namely **policy** for building sector, building rehabilitation, training, energy performance certification;
- Evolution, availability and accessibility of new **technology** solutions.



PRIORITY MEASURES

STRATEGY OVERVIEW

The basic and general idea to overcome the identified barriers of adequacy, costs, age and uncertainty at economic, political and technological level, stand on the promotion of training as an added value for companies and persons themselves, specifically by:



- ➔ **Flexibility:** modular training courses, with the possibility of credit accumulation;
- ➔ **Companies involvement:** courses within the companies improving the practical component and reducing costs;
- ➔ **Cross-cutting training for energy efficiency:** the concept of energy efficiency in buildings and renewable energy sources becoming a cross-cutting issue in all building workers qualifications;
- ➔ **Requalification:** specific programmes, in the actual economic and social Portuguese context, should be implemented, particularly targeted at unemployed workers, in order to promote their inclusion in the energy efficiency and renewable energy sources building sector.

Considering the economical restrictions for investment and incentives and the strong deceleration of new constructions, the period 2014-2020 should be analyzed in the framework of crisis constraints, at least for the first years of the entire period.

The action plan includes three layers of action according to its operation level and target, namely:

- **Structural:** actions focusing on VET (Vocational and Education Training) system intervention (e.g. new qualifications, curricula revisions, new UFCD) and certification schemes.
- **Operational:** actions focusing on training the workforce and unemployed people, including those already taking training (young and adult people).

- **Supporting:** actions which support both structural and operation actions, involving a more abroad target (e.g. building owners, public, companies, employers).

The rationale behind of this organization is that any action taken into a layer (from structural to supporting) also influences also the other layers.



STRUCTURAL ACTIONS

The first group of actions refers to the VET provided in the framework of the National Qualification System and they could be divided into:

- *deep*: interventions in VET system that only could be implemented in a medium term perspective (not before 2016);
- *shallow*: interventions in VET system that require some adaptation measures, mainly by the training centers in terms of trainers, new materials, etc.; however, actions can be put in action in a short-term perspective.

Regulation process of some activities/professions in the context of the Regulation System for Access to Professions

In the scope of the Regulation System for Access to Professions (RSAP), it will be necessary to verify the admission requirements to regulated activities or professions from the training viewpoint, in order to match with the National Qualifications System (NQS). What is intended is that the National Qualifications System, via the qualification standards of the National Catalogue of Qualifications (namely the training and validation and certification of professional competences standards), corresponds to

the demands established to the access of a particular regulated activity /profession.

The implementation of Certification or Equivalent Qualification Schemes for installers of solar photovoltaic, solar collector, biomass boiler, shallow geothermal and heat pumps is mandatory due to Directive 2009/28/EC. The schemes may take into account existing UFCDs and the basic competences defined in the framework of CA-RES project. Taking into account those basic competences it will facilitate the definition of learning outcomes and will be very helpful for the mutual recognition as each Member State shall recognize the certification or equivalent qualification awarded by others Member States.

Initiatives in the National Qualification System framework

Updating of the qualifications of the National Catalogue of Qualifications

Presentation of proposals to redefine the training standards, in order to guarantee that training is adjusted to the targets of energy efficiency in the building sector, as well as to ensure that the professionals develop the necessary knowledge and skills associated to renewable energies, which should be increasingly used: in the energy sector and building construction sector. These proposals can be presented either by request of ANQEP, or by the initiative of the sectors entities, by means of the Open Model of Consultation.

The redefinition of the training standard means include skills other than the currently considered, namely:

- Solar Photovoltaic Installer: the existing training and RVCC standards should be updated in order to achieve the Basic Competences pointed out from CA-RES project.
- Solar Thermal Collector Installer: the existing training and RVCC standards should be updated in order achieve the Basic Competences pointed out from CA-RES project.

Presentation of proposals for new qualifications, namely:

- Shallow Geothermal Installer
- Energy Efficiency Technician

Introduction of crosscutting units in the training standards of the National Catalogue of Qualifications

Definition of basic skills related to energy efficiency, which may be considered crosscutting and mandatory, may be crucial in all qualifications of the education and training areas of the building construction, by drawing short training units. This upgrade should focus not only on new materials, new techniques and construction methods, new alternative solutions, but also on general knowledge and awareness for energy efficiency, reinforcement of practical training and buildings rehabilitation.

These units are to be used for the up-skilling of the building workers, which is fundamental for the successful implementation of low energy buildings. This measure implies the articulation of the Sector Council for Energy and Electricity with the Sector Council for the Qualification of the Building Sector.

Measures of partial certification

Within the framework of the NQS, it is important to trigger a process of formal recognition of essential skills for the access of certain activities/professions, accepted by labor market, when they do not yet correspond to a qualification. Therefore, it is important to identify partial/intermediate certification paths, integrated in qualification paths of the NCQ, worthwhile for the labor market. It is still necessary to define the model and the certification instruments for these partial/intermediate certification paths. This measure aims at responding to: specific needs of non regulated activities, access to regulated activities/professions and to sector certifications. This measure may become a driver for the motivation of the training pursuit.

OPERATIONAL ACTIONS

The direct target of operational actions aims at the group of craftsmen and installers, active or unemployed, as well as other potential workers such as young people. This type of actions mainly consists in creating opportunities of training within the targeted people, using the existing training schemes.

Occupations related to RES

In order to comply with the objectives of Renewable Energies Directive 28/2009/EC and with PNAER, it is required to put forward specific training programmes for:

- PV installers
- Wind power generation installers
- Solar thermal installers
- Biomass boilers and stoves
- Heat pumps installers
- Shallow geothermal installers

The above programmes are targeted to upgrade the workforce or requalify other occupations in renewable energy systems, by creating two main areas according to the background - electricity or hydraulic - allowing the (re)qualification of the former to photovoltaic installers and the latter to solar collector, biomass, heat pumps and shallow geothermal installers.

Occupations related to Energy Systems (other than RES)

The implementation of the national regulation following the EPBD-Recast requires reinforcement/creation of training actions for:

- electrician-assembler of low voltage installations, for qualification as lighting systems expert;
- HVAC systems installers¹² according to new certification and renewal demands.;
- boilers installers according to new certification and renewal demands;
- Training actions for the management/operation of energy systems technicians according to new to-be-defined professional profiles.

Occupations related to building envelope

In order to accomplish the targets/objectives defined on the national plan for energy efficiency (PNAEE), training programmes are needed to thermal insulation installers, including bricklayers, as well as windows installers.

¹² Technical installation and maintenance of HVAC systems (TIM).

SUPPORTING ACTIONS

Measures of promotion to access training

Schemes of intervention for the training and qualified integration of workers in the sector

Since the objective is to improve the qualification of workers in the building construction, employed or unemployed, in what concerns the knowledge and the skills in relation to the energy efficiency, it will be useful to implement qualifying responses, allowing the development of relevant skills. These responses aim at improving the performance of workers, thus eventually allowing a rising career for the employed and enhancing employment for the unemployed. These actions may take the form of short duration training programs, being the priority audience targets defined according to national employment measures and programs in a sector perspective.

These training programs can be organized with short training units of the National Catalogue of Qualifications (NCQ) or based on training curricula not belonging to the NCQ, provided that it is developed by a training provider certified in the scope of the National Qualifications System, thus allowing its certification. In this context, possible programs were identified according to the audience targets, such as:

- Programs to support the training of unemployed in construction;
- Programs to support the up-skilling of low level qualification workers in construction;
- Programs to support the training of unemployed in other sectors.

Information campaign about the importance of low energy construction

This measure should focus on the economical and environmental advantages of the low energy buildings, aiming at its recognition on the market.

The campaign is targeted to the building sector (namely those who are directly involved in the development and operation of buildings) in a context of economical crisis and should also promote the recognition that using new technologies leading to low energy buildings, both at construction level and at retrofitted buildings, is a reliable investment and opportunity to relaunch the sector.

It is also targeted to the users of buildings and intends to educate and motivate behaviors that value energy efficiency in investment decisions.

ACTION PLAN

STRUCTURAL (M.ST.)

	ACTION LINE	MEASURES	MOTIVATION	TARGET	TIMELINE	ENTITIES INVOLVEMENT	ESTIMATED COST (k€)	FINANCING SCHEMES
M.ST.1	Regulation System for Access to Professions (RSAP)	Regulation Process of some activities/professions in the framework of RSAP	Correspondence between National Qualifications System and the assessment to regulated activities /professions.	NQS	2013-2020	ANQEP; CRAP; Representative entities of the sectors	tbd	tbd
M.ST.2.1	National Catalogue of Qualifications (NCQ)	Updating of the qualifications of NCQ	Adjustment of specific training standards to energy efficiency measures and skills associated with renewable energies	NQS	2013-2020	Sector Councils for Qualifications	tbd	tbd
M.ST.2.2.	National Catalogue of Qualifications (NCQ)	Introduction of crosscutting units in the training standards of NCQ	Adjustment of all training standards by introducing general knowledge of energy efficiency measures and renewable energies	NQS	2013-2015	Sector Councils for Qualifications	tbd	tbd
M.ST.3.	National Qualification System	Measures of partial certification	Increase the motivation of the training pursuit and increase the interaction with the market.	NQS	2013-2020	ANQEP; CSQ	tbd	tbd

OPERATIONAL (M.OP.)

	ACTION LINE	MEASURES	MOTIVATION	TARGET	TIMELINE	ENTITIES INVOLVEMENT	ESTIMATED COST (k€)*	FINANCING SCHEMES
M.OP.1	Renewables for electricity	Training actions for wind and PV Installers	Comply with the objectives of Renewable Energies Directive 28/2009/EC and with Portugal National Renewable Energy Action Plan	500-700 Y: 100-150 W: 300-400 U:100-150	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	400-700	**
M.OP.2	Renewables for heating and cooling	Training actions for Solar Thermal Installers	(idem)	8 000-13 000 Y: 1400-2000 W: 5200-9000 U:1400-2000	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	6400-13000	**
M.OP.3	Renewables for heating and cooling	Training Actions for Installers of Biomass Boilers and Stoves	(idem)	3000-5000 Y: 700-1000 W: 1600-3000 U:700-1000	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	2400-5000	**
M.OP.4	Renewables for heating and cooling	Training Actions for Heat Pumps Installers	(idem)	1000-2000 Y: 250-400 W: 500-1200 U:250-400	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	800-2000	**

M.OP.5	Renewables for heating and cooling	Training Actions for Shallow Geothermal Installers	(idem)	50-100 Y: 10-20 W: 30-60 U: 10-20	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	30-100	**
M.OP.6	Energy systems other than RES	Training actions for electrician-assembler of low voltage installations, for qualification as lighting systems expert	Implementation of the national regulation that follows the EPBD-Recast	1 400-2 100 Y: 300-380 W: 1000-1520 U: 100-200	2014-2020	Professional associations, Industrial/commercial associations, Training providers, Training centers	1120-2100	**
M.OP.7	Energy systems other than RES	Training actions for HVAC systems Installers (including TIM's) according to new certification and renewal demands.	(idem)	10 700-11 500 Y: 1900-2100 W: 8000-8400 U: 800-1000	2014-2020	Professional associations, Industrial/commercial associations, Training providers, Training centers	8560-11500	**
M.OP.8	Energy systems other than RES	Training Boilers installers according to new certification and renewal demands	(idem)	3000-5000 Y: 700-1000 W: 1600-3000 U:700-1000	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	2400-5000	**
M.OP.9	Energy systems other than RES	Training actions for the management/operation of energy systems technicians according to new to-be-defined professional profiles.	(idem)	1 100-2 000 Y: 600-1000 W: 400-800 U:100-200	2014-2019	Professional associations, Industrial/commercial associations, Training providers, Training centers	880-2000	**

M.OP.10	Building envelope	Training actions for insulation Installers	Accomplish with the targets/objectives defined on the national plan for energy efficiency (PNAEE)	1 450-3 000 Y: 300-600 W: 1000-2100 U:150-300	2014-2020	Professional associations, Industrial/commercial associations, Training providers, Training centers	1160-3000	***
M.OP.11	Building envelope	Training actions for windows installers	(idem)	1000-2000 Y: 200-400 W: 700-1400 U: 100-200	2014-2020	Professional associations, Industrial/commercial associations, Training providers, Training centers	800-2000	**

Y: young trainees, W: workforce, U: unemployed.

TIM: technical installation and maintenance of HVAC systems.

* Cost assumption of 800€ to 1000€ per trainee.

** Governmental funds, EU funds

OPERATIONAL MEASURES	workforce	youth	unemployed	Total
Trainees	20 730-31 380 (~67%)	6 460-9 050 (~20%)	4 010-5 970 (~13%)	<i>31 200-46 400</i>
Investment cost (M€)	17-31	5-9	3-6	<i>25-46</i>

SUPPORTING (M.SP.)

	ACTION LINE	MEASURES	MOTIVATION	TARGET	TIMELINE	ENTITIES INVOLVEMENT	ESTIMATED COST	FINANCING SCHEMES
M.SP.1	Promotion training assessment	Schemes of intervention for the training and qualified integration of workers in the sector	Motivate workers for training	Employers and employees	2013-2020	Ministry of Economy and Employment, ANQEP, IEFP, Social partners, Trade unions	tbd	tbd
M.SP.2	Informative campaign	Promote the importance of low energy buildings	Educate and motivate behaviors that value energy efficiency in the decision of investment	Companies, building owners and general public	2013-2015	Public and private organisms with responsibilities in EE and RES	tbd	tbd

CONCLUSIONS

The Portuguese roadmap for training craftsmen and installers working in the building sector outlines the way to pursue, in the next seven years, a path to up-skill the workforce on energy efficiency (EE) and renewable energy sources (RES) practices.

The report of the Status-Quo in the framework of BUILD-UP SKILLS project, dated from October 2012, highlights that training is required in all occupations, since the more related to the building envelope through the conventional and RES energy system; building construction stage to building operation and systems maintenance; current workforce to youth and unemployed.

The current workforce related to EE and RES, due to the lack of up to date statistical data, is estimated to be around 55 to 65 thousands, representing around 15-17 percent of the building sector workforce (figures from 2012).

The National Actions Plans for EE and RES (PNAEE and PNAER) from 2013, still to be officially released, point out the goal of decreasing 1.5 Mtoe in final energy, by 2016, and 8 Mtoe in primary energy, by 2020. In order to reach those goals, a number of occupations are directly involved: RES, HVAC and boilers installers, electrician specialized in lighting systems, windows and thermal insulation installers, building operation and management.

The action plan is assembled in structural, operational and supporting actions. The structural measures mainly regard the Vocational and Educational Training (VET) system and consist of a set of recommendations to improve the current qualification standards or to regulate activities/qualifications. This set of measures should be implemented in the first half of the roadmap period (2014-2016) in order to have a significant impact on the energy targets set for 2020.

The operational measures consist of training programs targeted to the identified skills needs. The total number of workers to be qualified (or up-skilled) is around 31 to 46 thousand. From those, a total of 67 percent comes from the current workforce and the remaining from the youth (20 percent) and unemployed (13 percent), in the first group by programmes of qualification or in the second one by requalification.

With the rationale of an average 800€ to 1000€ per trainee, the investment cost for the set of operational measures is in the range of 25-46 million Euros.

Supporting actions complete the actions described above, acting as drivers for training the workforce as well as for creating EE and RES requirements in companies, building owners and general public.

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