RENEWED SKILLS

Lifelong Learning Programme

Recognition of competences in the renewable energy sector in the EU

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INTERNATIONAL COMPARATIVE REPORT

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1. Introduction

Renewed Skills is a Leonardo da Vinci project, promoted by FITAG-UGT and developed in France (Mps), Germany (Bfw), Italy (Ceres, Qbit), Poland (Procesy) and Spain (IFES).

The Renewed Skills project is aimed to adapt a methodology for the recognition of competences acquired by low/medium qualified workers (EQF levels 1 to 4) through non-formal and informal learning in the training strategies of the renewable energy sector in the EU. This will be achieved through an exchange of experiences among social partners, VET centres, companies and public administrations.

The specific objectives of this project are:

- To get updated knowledge about the socio-labor situation in the renewable energy sector in Europe.
- To integrate the recognition of non-formal and informal learning with the evolution of the productive system, the labor market demands and the vocational training.
- To identify, select and analyse experiences and good practices of non-formal and informal learning recognition of the low/medium qualified workers in the energy sector in Europe.
- To design an e-learning proposal, addressed towards Public Administrations.
- Companies, VET centers and social partners, in order to incorporate the recognition of non-formal and informal learning in the training strategy of the energy sector in each participating country.
- To elaborate and disseminate a guide for the transparency of qualifications in the energy sector in the EU.

With this purpose, partners of the Renewed Skills project have developed some national reports which attend these main objectives. The document that we are presenting is a comparative report for unifying criteria according to the expertise in the EU and the exchange of opinions among participating countries, in order to ease the implementation of a methodology for the recognition of competences acquired through non-formal and informal learning in the RES. The contents of this report are as follows:

- **The renewable energy sector: socioeconomic facts and labour data**. This chapter presents the general overview of the sector, specifying how the connection between public and private actors work, what are the most diffused kinds of renewable energy production, the influence of external factors on the sector (i.e. the impact of public funding to support the sector, the EU recommendations), and the economic enterprising configuration (such as the number of enterprises, enterprise dimensions, geographic distribution).

- **The socio-labour situation in the renewable energy sector**. This chapter shows the social and institutional profile of the workers in the sector and the training needs in the sector, focusing on the existing training activities, the barriers and difficulties in training access for workers and their needs.

- **The recognition of qualifications: experiences in the sector**. This chapter shows the system of recognition of competences in the partner countries, with experiences and good practices about recognition and accreditation of non-formal and informal learning in the renewable energy sector.

2. The renewable energy sector: economic data and the employment market

The Renewable Energie Sector (RES) encompasses all those companies that carry out activities, such as the production of elements, the creation and installation of systems, the production of energy in itself, distribution, transport, marketing, etc.

In light of the fundamental role played by energy in the development of modern societies, the energy policy is based on three main factors:

- Supply security.
- The preservation of the environment.
- Economic competitiveness.

Countries tend to implement two strategies in order to comply with these requirements:

- The promotion of energy saving and enhanced energy efficiency
- The development of renewable energies.

The promotion of the use and development of renewable energies represents benefits for the countries. The development of the energy sector would lead to: the generation of jobs, the need for professional qualifications, the application of high-technology, the development and implementation of R&D&I, the preservation of the environment, the harnessing of new, cleaner resources, the manufacture of components for industries from the energy sector, which would imply the commissioning of research programs, and the emergence of new sources of employment.

The following subsections of this chapter draw comparisons on the performance and structure of the RES in participating European countries and present the general overview of the sector, analysing changes and perspectives.

2.1. Introduction

Investment dynamics in Europe show a strong market interest in renewable technologies for the production of electricity. Renewable sources of energy, in fact, are reshaping the European energy scenario, with important results in terms of distribution and production in recent years. The European energy situation today is less dependent on oil and coal supply, it is cleaner and more advanced, bringing the production of energy closer to the expected demand of households and firms, with obvious advantages in terms of reduced imports, local and global pollution.

The strategy adopted through a set of regulatory and economic tools (tariffs, including feed-in tariffs and green certificates) brought about a significant increase in the production of electricity from renewable sources and energy savings, especially with regard to minimizing the use of electricity in the domestic sector[1]. Also according to the OECD, Europe is generally on the right track to reach the target of energy produced from renewable sources in gross final consumption established for the year 2020[2].

[1] OECD Report on environmental performance. October 2012.
[2] Climate Package Climate-Energy Package "20-20", in fact, provides a strong contribution of renewables to achieve the objectives of the new European energy policy.

Moreover, renewable technologies are today reliable and competitive: in recent years a new industrial network has been created, made of industrial and craft enterprises, production and processing, design and installation, management and maintenance that make the organizational framework of firms a key characteristic of this sector.

The data related to the installed power of renewable technologies present in each country reflects the importance of the sector, the size, geography and socio-economic make-up of the country, and the extent of maturity and development of the sector.

Table 1: Energy country factsheets 2012 (data referred to 2010)

Energy balance – Mtoe						
Country	Spain	France	Germany	Italy	Poland	EU27
Production	34.3	135.0	132.0	30.9	67.8	837.2
- Renewables	*14.7*	*20.8*	*32.7*	*16.3*	*6.8*	*166.6*
Imports	121.5	163.0	241.9	180.2	47.4	1,444.1
- Renewables	*0.8*	*0.4*	*0.5*	*1.8*	*0.4*	*9.5*
Exports	15.2	29.4	39.3	30.7	15.3	491.8
- Renewables	*0.4*	*0.2*	*0.6*	*0.1*	*0.0*	*4.2*
Net Imports	106.3	133.6	202.6	149.5	32.1	952.3
- Renewables	*0.4*	*0.2*	*-0,2*	*1.7*	*0.4*	*5.2*
Gross Inland Consumption	130.2	268.6	336.1	175.5	101.7	1,759.0
- Renewables	*15.1*	*21.0*	*32.6*	*18.0*	*7.3*	*172.1*
- Hydro	*3.6*	*5.3*	*1.8*	*4.4*	*0.3*	*31.5*
- Wind	*3.8*	*0.9*	*3.2*	*0.8*	*0.1*	*12.8*
- Solar	*1.0*	*0.1*	*1.5*	*0.3*	*0.0*	*3.7*
- Tide, wave and ocean	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
- Biomass and Renewable wastes	*6.6*	*14.5*	*25.6*	*7.8*	*6.9*	*118.2*
- Geothermal	*0.0*	*0.1*	*0.5*	*4.8*	*0.0*	*5.9*
Final Energy Consumption	90.6	158.8	217.4	124.8	66.3	1,153.3
- Renewables	*5.6*	*12.9*	*13.5*	*5.3*	*5.2*	*78.5*
- Solar	*0.2*	*0.1*	*0.4*	*0.1*	*0.0*	*1.5*
- Biomass and Renewable wastes	*5.4*	*12.8*	*12.6*	*5.0*	*5.2*	*76.1*
- Geothermal	*0.0*	*0.1*	*0.5*	*0.1*	*0.0*	*0.9*

Sources: Eurostat: COMEXT-Sirene Energy db/April 2012; CHP survey/April 2012; RES survey/October 2012. EEA: UNFCCC-GHG/ as of Nov 2012. ECFIN: AMECO macro-economic data November 2012. Own elaboration on *Energy country factsheets 2012* data, European Commission – DG Energy, available at http://ec.europa.eu/energy/observatory/countries/doc/2012-country-factsheets.pdf

Table 2: Energy country factsheets 2012 (data referred to 2010)

Electricity Production						
Country	Spain	France	Germany	Italy	Poland	EU27
Gross Electricity Generation, by fuel - TWh	303.1	569.0	627.9	302.1	157.7	3,345.6
-Renewables	*100.7*	*82.6*	*110.5*	*80.3*	*11.5*	*699.3*
- Hydro	*45.5*	*66.8*	*27.4*	*54.4*	*3.5*	*397.7*
- Wind	*44.2*	*10.0*	*37.8*	*9.1*	*1.7*	*149.1*
- Solar	*7.1*	*0.6*	*11.7*	*1.9*	*0.0*	*23.1*
- Tide, wave and ocean	*0.0*	*0.5*	*0.0*	*0.0*	*0.0*	*0,5*
Biomass and Renewable wastes	*3.9*	*4.7*	*33.7*	*9.4*	*6.3*	*123.3*
Geothermal	*0.0*	*0.0*	*0.0*	*5.4*	*0.0*	*5.6*
Installed Electricity Capacity - MW	102,730	125,918	163,766	108,689	33,497	904,125
- Hydro	*18,535*	*25,476*	*11,028*	*21,521*	*2,342*	*145,117*
-Geothermal	*0,0*	*0.0*	*8*	*728*	*0,0*	*762*
- Wind	*20,759*	*6,019*	*27,209*	*5,795*	*1,108*	*84,696*
- Solar	*4,598*	*1,007*	*17,320*	*3,470*	*0,0*	*29,974*
- Tide, wave and ocean	*0,0*	*240*	*0.0*	*0.0*	*0,0*	*241*
- Wood, Wood waste	*545*	*375*	*2,014*	*406*	*53*	*15,381*
- Biogas	*189*	*187*	*2,725*	*480*	*81*	*6,113*
- Liquid Biofuels	*0,0*	*0.0*	*275*	*581*	*0,0*	*1,001*

Sources: Eurostat: COMEXT-Sirene Energy db/April 2012; CHP survey/April 2012; RES survey/October 2012. EEA: UNFCCC-GHG/ as of Nov 2012. ECFIN: AMECO macro-economic data November 2012. Own elaboration on *Energy country factsheets 2012* data, European Commission – DG Energy, available at http://ec.europa.eu/energy/observatory/countries/doc/2012-country-factsheets.pdf

Table 3: Energy country factsheets 2012 (data referred to 2010)

Transport fuels - ktoe						
Country	Spain	France	Germany	Italy	Poland	EU27
Production Biofuels	1,022.8	2,261.1	4,5890.0	1,456.8	456.7	12,940.3
Final Consumption Biofuels - Transport	1,435.6	2,420.4	2,960.4	1,466.2	886.5	13,271.9
Final Consumption Petroleum Products Transport	35,436.5	46,540.7	57,265.2	38,878.5	16,209.1	343,660.9
Biofuels production capacity – kton	4,894.9	3,890.0	8,987.9	2,544.2	0.0	26,893.6
Share of Biofuels in transport fuels - %	4.6%	5.7%	5.8%	4.2%	6.0%	4,4%

Sources: Eurostat: COMEXT-Sirene Energy db/April 2012; CHP survey/April 2012; RES survey/October 2012. EEA: UNFCCC-GHG/ as of Nov 2012. ECFIN: AMECO macro-economic data November 2012. Own elaboration on *Energy country factsheets 2012* data, European Commission – DG Energy, available at http://ec.europa.eu/energy/observatory/countries/doc/2012-country-factsheets.pdf

Table 4: Energy country factsheets 2012 – data referred to 2010

Main Energy Indicators						
Country	Spain	France	Germany	Italy	Poland	EU27
Final Electricity per capita – KWh per capita	5,655.8	6,850.6	6,469.9	4,948.7	3,102.9	5,654.9
Import dependency - %	76.7	49.3%	59.8%	83.8%	31.5%	52.7%
Gross Electricity Generation - %						
- Renewables - %	*33.2%*	*14.5%*	*17.6%*	*26.6%*	*7.3%*	*20.9%*
RES share of the gross final energy - %						
- RES-H&C Heating and Cooling	*12.7%*	*16.9%*	*10.5%*	*9.5%*	*12.0%*	*14.3%*
- RES-E – Electricity Generation	*29.5%*	*14.9%*	*18.1%*	*20.1%*	*6.7%*	*19.6%*
- RE-T - Transport	*4.7%*	*6.1%*	*5.7%*	*4.8%*	*5.9%*	*4.7%*

Sources: Eurostat: COMEXT-Sirene Energy db/April 2012; CHP survey/April 2012; RES survey/October 2012. EEA: UNFCCC-GHG/ as of Nov 2012. ECFIN: AMECO macro-economic data November 2012. Own elaboration on *Energy country factsheets 2012* data, European Commission – DG Energy, available at http://ec.europa.eu/energy/observatory/countries/doc/2012-country-factsheets.pdf

Despite the differences in the countries, the share of renewable energy sources has steadily increased over the last ten years.

In **Spain**, consumption of renewable energies in terms of final energy in 2011 rose to 15.9%, whereas the target defined in the European Directive 2009/28/CE is 20% of final energy by 2020. Despite this increase, a slight drop was registered in the electricity generated using these technologies.

In **France**, since most of the electricity production comes from nuclear, other renewable energy sources, which include wind, represent a fraction of the electricity production. Among them, wind occupies the second place and it is also the energy that has grown the most over the past 10 years.

In **Germany**, the share of renewable energy steadily increased to 12.6% of total final energy consumption. Compared internationally, the German renewable energy sector remains in the lead: the share of the worldwide market for the wind energy branch amounts to over 25%; moreover, Germany is the worldwide leader in the installed capacity of photovoltaic systems and comes in second with wind power installations.

Similarly, in **Italy**, the network of large and small plants, both thermal and electrical, make up an increasingly distributed system which in 2012 has guaranteed 13% of the total consumption in the country[3]. This is the result of a major rise in installations in recent years, especially in the photovoltaic systems: in 2011, Italy installed 33% of the worldwide capacity of solar panels, reaching a capacity which is second only to Germany.

In the case of **Poland**, energy sector is based primarily on coal technologies, since this country is the largest producer of coal in the European Union. However, the share of other energy sources is increasing, especially as concerns renewable energy sources, which share of installed capacity in 2012 amounted to slightly more than 11%.

2.2. The influence of external factors in the sector

Since Europe depends largely on imports to meet its energy needs, the European Union and National governments promotes considerable investment in energy efficiency and the generation of energy using indigenous sources such as clean energies.

The energy challenge in fact is one of the biggest issues facing Europe today and the aim of energy policies is to ensure a safe, secure and sustainable energy supply at affordable prices. The policies of the EU Member States are built around the EU's '20-20-20' targets, which have to be met by 2020:

- 20% reduction in EU greenhouse gas emissions compared to 1990 levels.
- 20% of energy consumed in the EU from renewable sources.
- 20% improvement in the EU's energy efficiency.

The European energy market is the world's largest regional market (over 500 million consumers) and largest energy importer. Several of the challenges facing the EU – climate change, access to oil and gas, technology development, energy efficiency – are common to most countries and call

[3] Legambiente: www.fonti-rinnovabili.it

for international collaboration. To this end, international energy policy must pursue the common goals of **security of supply, competitiveness and sustainability**.

Promotion throughout Europe has led to a spectacular increase in the production capacity of renewable sources, with conventional power stations lagging some way behind. The cost of solar panels has fallen by 50% over the last 5 years. In 2009, the industrial renewables sector was already worth €70 billion and employed over half a million people in Europe.

This is because European legislation has a major impact on National legislation, especially in the energy field. The European Parliament and the Council of Ministers of the European Union jointly adopt European energy legislation, except for legislation on nuclear power and energy taxation. EU Member States are free to develop whichever energy sources they want. They must, however, take account of European renewable energy objectives.

Directive 2009/28/CE in particular, aim to establish a common framework for the production and promotion of energy from renewable sources. A target has been set for each Member State for the amount of energy from renewable sources in gross final consumption by 2020. This goal is consistent with the overall objective of "20-20-20" of the Community[4].

Table 5: EU 2020 Targets

Renewable Energy in Gross Final Energy Consumption			
%	2011 RES Share	2011/2012 Interim Target	2020 RES Target
Spain	15.1%	10.9%	20.0%
France	11.5%	12.8%	23.0%
Germany	12.3%	8.2%	18.0%
Italy	11.5%	7.6%	17.0%
Poland	10.4%	8.8%	15.0%
EU27	13.0%	10.7%	20.0%

Sources: Eurostat, April 2013. Own elaboration on "EU energy in figures – Statistical pocketbook 2013", available at http://ec.europa.eu/energy/publications/doc/2013_pocketbook.pdf

In accordance with the so called Renewable Directive, each Member State is obliged to draw up a National Renewable Energy Action Plan, containing the national goals in relation to the amount of renewable energy consumed in transport, electricity and the production of heat and cold in 2020.

The Directive sets forth the flexible mechanisms for helping the Member States achieve their set targets:

- Statistical transfers. A Member State may purchase production from another State (for statistical purchases) in order to meet the targets.

- Joint projects. A Member State may support specific projects involving new renewable energy generation in another Member State (or a non-member country if the energy is consumed in EU territory).

- Mechanisms of joint-support. May establish a common market of green certificates or a common regulated tariff for electricity from a renewable source.

[4] Resort from the Commission, 13 November 2008 entitled "Energy efficiency: delivering the 20% target" [COM (2008) 772 – Not published in the Official Journal].

As a consequence of the provisions of the European Directive, and with the aim of promoting the use of energy from renewable sources, **Spain** has drawn up a *National Energy Plan* (PEN) and a *National Renewable Energy Action Plan* (PANER) establishing growth objectives for all renewable energies, particularly those from wind, solar and biomass sources.

Therefore, the role of public subsidies for "green energy" has been a decisive factor for the same having taken off in Spain. However, this dependency on public support has also caused fluctuations in the development of the activity, including the maintenance of the same (which means fluctuations in employment). According to the experts interviewed, there has been a significant slowdown in investment at national level in renewable energies, meaning many of the large producers/distributors are striving to invest in other markets. Public subsidies for renewable energies were also responsible for the boom the sector enjoined in the past. Large producers/distributors, but above all SMEs, regarded this subsidy policy as a unique opportunity for gaining a foothold in the sector, and for ensuring their investment proved to be profitable in the short and medium-term. The significant reduction in funding has meant many of these SMEs are now finding it difficult to stay in the business. All this affects all the "links" in the chain: producers, manufacturers of equipment, installers, ecc.

In **Germany**, the *Renewable Energy Sources Act* (EEG) is a key component in the implementation of the Directive 2009/28/CE on the promotion of the use of energy from renewable sources. Within the energy sector, the EEG has been an important instrument since the year 2000 for promoting renewable energies.

The act was amended on 1 January 2012 and aims to increase the share of renewable energy to at least 80% of generated electricity until the year 2050. The act regulates the grid connections of installations which remuneration is to be paid to the installation operators for the electricity generated per kilowatt hour within a specific period of time. Furthermore, the act regulates the grid operators' priority obligation to purchase and transmit electricity from renewable energies. The act, finally, standardises how renewable electricity is to be marketed and how the cost differential between the costs of marketing electricity from renewable energies and the statutory remuneration are to be distribuited among electricity consumers.

In **Italy**, Directive 2009/28/EC was implemented by the Legislative Decree no. 28/2011. The growth of renewable sources in Italy, therefore, is in line with the European targets for 2020 set out in the *National Action Plan for Renewable Energy* in 2010: if the current trends are confirmed and the country will provide the appropriate tools, these objectives may be widely exceeded, well beyond the European target of 17%.

Poland's energy policy objectives have been formulated in the Council of Minister's Resolution of 10 November 2009 entitled "*Energy Policy of Poland until 2030*". In addition to the legislative elements supporting the production of energy from renewable sources, an important factor encouraging investments in renewables are EU funds in the financial perspective 2007-2013. The overall amount of about 9.5 billion euro is potentially available for use for RES development. Substantial support for renewable energy sources comes also from the National Fund for Environmental Protection and Water Management (NFEPWM), which includes grants, long-term low-interest loans, and support from provincial, district and local funds for environmental protection and water management.

Likewise other EU Member States, in **France** a number of European and National instruments aid to finance energy project, such as the Structural Funds and bank loans (World Bank or ERBD). In particular, among the European programs there's the FP7 (Framework Programme for Research and Development from 2007 to 2013) in which the theme "Energy" is to contribute to the evolution of the current energy system in the long term to ensure independence and reduce emissions of greenhouse gases. The two IEE (Intelligent Energy Europe) finance projects in the field of energy efficiency and renewable energy in the building sector, industry, transport, with local or regional initiatives.

ADEME is the French Agency for Environment and Energy Management and the Grenelle Environment Forum is a series of political meetings organized in France to take long-term decisions on the environment and sustainable development. Depending on the objectives of the Grenelle Environment, renewable energy should produce 23% of the French energy consumption by 2020.

2.3. Economic enterprising configuration

Taking into account that in the European participating countries is hard to quantify the number of companies strictly involved in renewable energies, data presented in the table below refers to the performance, economic contribution and structure of the whole activities related to the energy sector, which includes those of RES industry.

So, according to the Comparative Table with Eurostat (NACE rev 2) this sector complies with companies involved in Electricity, Gas, Steam and Air Conditioning Supply (NACE D35) and with the following activities:

35.11: Production of Electricity (Hydroelectric, Fossil Fuel, Nuclear)
Electric Power Generation (Solar, Wind, Geothermal, Biomass, Tidal)
35.12: Transmission of Electricity
35.13: Distribution of Electricity
35.14: Trade of Electricity

Table 6: Socio-Economic Indicators in the EU[5]

Enterprises in the *Electricity, Gas, Steam and Air Conditioning Supply* (D35)									
Country	Number of Enterprises			Turnover			Number of Employed		
	2009	2010	2011	2009	2010	2011	2009	2010	2011
Spain	12.707	13.098	16.007	64.370	59.706	92.123	48.089	48.687	52.444
France	6.519	14.337	18.545	103.395	109.649	112.182	-	170.194	-
Germany	1.672	1.722	1.722	380.564	426.882	424.711	224.119	221.264	221.492
Italy	2.930	4.028	-	151.962	160.950	163.365	85.443	86.414	85.432
Poland	2.079	2.047	2.503	39.851	42.567	44.740	152.604	162.409	152.650
EU27	39.028	51.400	62.890	1.139.031	1.220.000	1.290.148	1.203.700	1.212.743	1.198.854

Sources: Eurostat, April 2013. Own elaboration on "EU energy in figures – Statistical pocketbook 2013", available at http://ec.europa.eu/energy/publications/doc/2013_pocketbook.pdf

[5] According to the Structural Business Statistics Survey (SBS). DG Energy Estimations. Source: Eurostat, SBS, NACE rev.2, sbs_na_ind_r2, June 2013

The renewable energies registering the biggest growth in **Spain** are photovoltaic solar, thermal solar and wind energy. The sector can really be defined as heterogeneous. Certain renewable technologies, such as mini-wind and photovoltaic energy, allow for the use of small facilities for personal consumption, or technologies geared to greater power such as geothermal or thermoelectric solar. This wide range of technologies is one of the reasons for understanding the diversity of companies comprising the sector.
In Spain there are two clear profiles of companies:

- Conventional energy companies or construction firms which in renewable energy have discovered a means of diversifying their business.
- Recently-founded companies with less than 20 years of existence and a far lower number of employees.

The sector is highly stable in terms of labour, and over 80% of contracts are of a permanent nature. Most companies are involved in installation; those dealing with maintenance account for 20%, around 14% market equipment, and 13% produce energy.
Madrid is the province with the greatest number of companies registered with the Social Security under related activities, both in wind power and other types of energy, due to the fact large corporations base their head offices in this city or nearby. Other provinces with a large presence of companies from the wind energy sector are: La Coruña, Soria, Zaragoza, Alava, Burgos, Valencia and Pamplona.

In **Germany** the main areas of activity are solar energy, wind energy, biofuels and hydropower. The expansion of wind energy use is particularly advanced in the Northern of the country whilst the majority of hydroelectric power installations can be found along the main rivers, owing to topographical conditions. Installations for the generation of electricity from biomass (particularly biogas installations) are predominantly found in rural areas, particularly in regions with intensive livestock farming and large-scale cultivation of renewable raw materials. The installations on an average are, much like with the farms, larger in the Northern and Eastern German Länder compared to the Southern and Western Länder. Disperse distribution is characteristic in the use of photovoltaics although the Southern German Länder are at the forefront with their installed capacity based on natural conditions (solar radiation)[6].

Based on installed capacity, around 40% of the renewable energy installations in Germany in 2010 were owned directly by private individuals, followed by project engineers (14.4%), farmers and banks or funds (11%), 6.5% were owned by the large power companies (three-quarters of which are hydropower) and 1.6% were owned by regional suppliers. In the photovoltaic and onshore wind energy sectors, private individuals are traditionally the most important investors with respectively 39.3% and 51.5%. Broad distribution within the ownership structure is due to the ready availability and user-friendliness of the renewable energy technology for private individuals, smaller businesses and industrial firms. It is worthing to note that in Germany, amongst the top 50, 28 are public limited liability companies.

In **France** the main companies in renewable energies are in the Hydropower, which is the second largest source of electricity behind nuclear. The RES brings growth and job creation mainly for SMEs, which represent 70% of recruitment needs. Company seeking human resources are mainly

[6] The Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR): http://www.bbsr.bund.de/cln_032/nn_497574/BBSR/DE/Raumbeobachtung/AktuelleErgebnisse/Raumentwicklung/ErneuerbareEE_im_Raum.html (access:30.04.2013)

those working with photovoltaic solar thermal and Heat pump but, after the peak of 2011, the trend was much less favourable in 2012.

While employment in activities related to improving energy efficiency of existing homes continued growing in 2010 and 2012, employment in activities related to the development of renewable energy (equipment and installation) decreased by 22% between 2010 and 2012, due to the massive reduction of jobs in the solar photovoltaic, wind and heat pumps. Meanwhile, some areas experienced slight progress, like biogas, wood collective, jobs related to improving energy efficiency and those related to improving market efficiency in trasport.

In **Italy** Renewable Energy Sources are experiencing a period of great development, taking on an increasingly important role in energy production.To date, in 2012 there where over 600 thousand plants in Italy from renewable sources, distributed in 98% municipalities. Before the second half of 2012 it was generally estimated, in fact, that the RES would be the only energy sector on the rise in terms of turnover, number of employees and energy produced. Focusing on renewable energy sources, in particular on solar, wind and geothermal, could be an extraordinary opportunity to create new jobs, reduce dependence on oil imports, as well as to stimulate research and technological innovation.

The geographical distribution of the *solar thermal* plants (which already employ about 15.000 workers)[7] showed a predominance of such installations in Northern and Central Italy, despite the great potential that exists in Southern Italy where these plants could meet all domestic requirements if properly designed and installed[8]. About the *Solar Photovoltaic*, currently in 2013, there are over 470 thousand photovoltaic systems, both large and small, mounted all over the national territory (140 thousand more than last year) distributed over 97% Italian municipalities. In terms of employment, there are more than 100 thousand people working in this area. *Eolic Power - Wind Farms* plants are distributed mostly in the towns of Southern Italy and in particular between the regions of Puglia, Calabria and Sardinia. They employ around 40,000 people, with an average annual growth of about 5,000 units.

In the case of **Poland**, the energy sector is based primarily on coal technologies. This is due to the fact that Poland is the largest producer of coal in the European Union. However, it should be noted that the share of other energy sources in the overall "energy mix" is increasing, especially as concerns renewable energy sources.

The current structure of the electrical power sector has been formed as a result of the consolidation of power companies owned by the State. The largest capital group in electricity production in Poland own a share of 37.8% of the national market.

3. The social and labour situation in the renewable energy sector

Nowadays, one speaks of the Green economy not so much as to define an emerging sector but rather with reference to a new economic model, based upon innovative production processes and consumption patterns. In such context, the Green economy represents a fundamental change of the production and consumption paradigm, and includes sectors such as energy efficiency in

[7] According to a study of AEE – Institute for Sustainable Technologies and the University of Wien, solar thermal, with an installed potential to 2020 between 97 and 388 million square meters, could bring about 450 thousand fulltime jobs.

[8] The potential for energy integration is huge when compared with the needs of the construction sector, much greater that other European countries, as in the case of Germany with more than 14 million square meters of solar panels, or Greece with 4 million and Austria with 3.9 million, compared to Italian 3 million square meters.

terms of production and distribution of renewable energies, sustainable means of transportation, organic agricultural production, the preservation of the water table and the enhancement of water in protected zones, sustainable tourism and the environment friendly management of urban waste. In particular, policies promoting energy efficiency, must include all sectors – manufacturing, tertiary, residential and transport – and connect to a number of policy interventions – normative, incentives, technological and behavioral – in such a way so as to favour the growth of new industrial and service sectors and new occupations, with major effects on the entire productive and occupational sectors. This transition towards a new type of economy generates new workplaces and professional developments, modifies existing ones and makes redundant others. It sifts through individuals who have both the necessary abilities and competences of facing up to the new challenges of sustainable development.

Moreover, the process of liberalization in the national grid system together with the incentives and awareness campaigns aimed at the general public has freed the existing agricultural, tertiary, retail, artisan sectors as well as households, prompting the increased development of smaller generation systems which are based on renewable sources (eolic, hydrofluid, biomass, solar photovoltaic)[9].

Furthermore, the European Union's concern with the climate change as well as the search for green, reliable energy sources is increasingly impacting the educational offer of universities and training companies. It is not surprising, therefore, that the rapid expansion of the renewable energy industry exerts pressure for the constant occurrence of new skilled engineers and technicians.

Across Europe, the shift towards low-carbon economy and the growing importance of knowledge-based economy offer a great potential for job creation.

In the tertiary sector there is a uniform trend towards broadening the range of skills required at all levels of professional work connected with "non-routine" tasks.
The renewable energy industry, as many other sectors based on specialist knowledge of employees, is going to increasingly require its employees to have managerial skills as well as scientific and technical knowledge.

All this, especially remarked for **Spain**, **Italy** and **Poland**, is still happening without a system of classification of professions which are oriented upon such functions, which would otherwise allow young people to take their decisions upon possible career choices in this sector in the future. In fact, when addressing the renewable energy employment market, it is hard to exactly define the occupations in the sector.

3.1. Workers in the sector: social and labour profile

From the spanish analysis emerges that most common occupations directly related to activities in connection with renewable energy are those which require professionally trained and skilled workers (electrical energy production personnel; maintenance and repair mechanics; electricians; machine tool operators; pipe fitters; welders) and graduates, normally university students, who perform executive and middle-management duties (top-level professionals in business organisation; technical and senior engineers).

[9] See: "Lotta ai cambiamenti climatici e fonti rinnovabili: Gli Investimenti, le Ricadute Occupazionali, le Nuove Professionalità" Rapporto di Ricerca – Bozza N. 04/2010 a cura di IRES, Istituto Ricerche Economiche e Sociali, pag. 11.

This is also remarked for **Germany**, where the proportion of employees with completed vocational training amounted to 82.1% in 2011. Those without completed vocational training amounted to 4.1% and the majority of this group was employed in the solar thermal and photovoltaic sectors. 32.1% of those employed in the branch had a degree of higher education.

In **Italy** statistics confirm the fact that people in technical/scientific professions are those categories enjoying highest demand. This new professional figure or traditional labour force workers, who are aware of ecological matters, generally possess a diverse portfolio of competences which are in turn inexorably linked with the structure and the different phases of development of individual production lines. This presents new challenges for both workers and the management structure who in turn require the intervention of politicians, technical people, and laws in order to guarantee healthy and safe working environments.

Once such professional figures are identified, it is necessary that an effective qualitative evaluation regarding aspects concerning organizational structure, retribution, professional development and in particular health and safety norms is held.

Renewable energy sources in **France** bring growth and job creation mainly for SMEs, which represent 70% of recruitment needs. Companies seeking human resources are mainly those working with photovoltaic, solar thermal and Heat pump.

The french study, moreover, highlights that the main obstacle to hiring seems to be the lack of training, followed by lack of mobility. Also, newcomers are they generally formed internally. According to the study, this phenomenon results from a practice rooted in the habits of SMEs, but also because the supply of external still need to be developed. This is also remarked for **Poland**, where companies are rarely involved in the development of curricula and are not interested in sharing their knowledge with students, especially in the case of technical skills in the field of "green economy", because they do not see this as a direct benefit for themselves. According to the opinions of employers and to the findings of other surveys, appropriate knowledge and competences related to the "green economy" are in many cases relatively easy to acquire through the fastest (and currently most convenient for employers) method of on-the-job training. Aniway, also in Poland there is a demand for highly qualified staff such as, for example, engineers able to apply their knowledge in the building of new models and systems. Their skills will also be useful in other, more complex areas such as heat recovery and wastewater treatment.

These highly specialised skills are not easy to acquire at Polish universities which are too heavily focused on theoretical knowledge. The polish report, particularly, stress the aspect that until 2011 there was a substantial gap between the training programmes offered by both private and public institutions and the market demand, particularly in relation to the needs of the "green economy".

3.2. Employment: emerging occupations

In general, the "environmental" employment market requires two types of worker:

- Those occupations common to economic activities of any nature: administrative personnel or construction workers.

- Technicians and scientific personnel (senior engineers, architects) are those with the most representatives in the energy market.

The productive processes related to renewable energy may be broken down into two categories defining different jobs:

- Operation and maintenance to perform tasks involving the running and management of energy generation facilities. These jobs are stable and last throughout the service life of the plant.

- Construction and installation. These jobs depend on the creation of new facilities.

In fact, while the 'green' training of the labour market and the development of new occupational profiles involves mainly the professional sector, it is no less important on the development of those whose jobs and professions are related to the construction of plants and who are responsible for their operation, both in the construction and industrial sectors[10].

Moreover, the training of professions potentially induced by energy efficiency appears to have a strong transversal character: innovation activates a demand for new professions in all ambits, involving both high rank professions as well as executive profiles. This emerges from a comprehensive analysis of the emerging professions (which range from engineers and architects involved in bio-construction to maintenance technicians responsible for the maintenance and the repair of heating systems) as well as from the closer analysis of the panorama of traditional occupations which surround these new job profiles and their modification aimed at satisfying the needs of the innovative technology and social processes.

Often, companies in the renewable energy sector have until now largely depended on workers who have not been qualified specifically in the branch but who have instead been qualified in conventional trade, industrial, commercial or academic occupations. This is because thus far, no apprenticeship trades exist which are oriented towards renewable energies and the number of graduates from relevat courses of study is still marginal compared to the overall need for academics.

In fact, many of the emerging occupational figures in this sector may be considered as the result of a whole process of adjustment in the traditional labour force through the acquisition of new 'green' skills, and can thus be associated with a process starting with the minimum reconfiguration of the classic worker profile, and the ultimate transition into a new proper occupation.

When considered across all branches in **Germany**, particular quantitative importance is given to the job descriptions of office administrators and industrial clerks, industrial mechanics, electricians, electronic technicians and mechatronics fitters.

German companies have expressed a need for engineers, electronic technicians, mechatronics technicians and mechanics and the following apprenticeship trades are currently in demand in the country:

- Electronics technician for industrial engineering.
- Information technology and telecommunications system electronics technician.
- Mechatronics fitter.
- Industrial mechanic.

[10] The Italian report provides the job descriptions relating to some 'new' professions, retained amongst the most significant within the field of the development of efficient energy: the *Sustainable construction designer* and the *Accredited Certyfing Official* for the Bioconstruction sector; the *Energy Manager* for the Esco sector; the *Mobility manager* for Trasport.

- Plant mechanic for sanitary, heating and air conditioning systems.

Semi-skilled and unskilled employees primarily perform the following work: operation of facilities, module replacement, updating software (modifying parameters), additions to or modifications of facility components. The fundamental competences of this group of employees follow: a feel for technology, mobility, language proficiency (English), system expertise (interdisciplinary approach) and a thorough manner of working.

In **France** it has been outlined, mainly, the request of engineers, project managers and technicians, but also commercial and counsellors. Among these, research and development engineer is qualified to work on all renewable energies (technical improvements in solar, wind, hydro). In **Poland**, particularly high increases are technicians expected in the fields of wind power, biomass and biogas, whilst in **Spain**, related to technology, the higer number of companies and new professionals are involved in wind energy, followed by solar thermal and geothermal energy.

To this end, employment in the sector encompasses a wide range of occupations. Many professionals from other sectors with the required qualifications and training may opt to work in renewable energy. Furthermore, this will allow the creation of new jobs mainly in productive regions in rural areas where there were few industrial opportunities until now.

As outlined in the Polish study, within the next 10-15 years it is expected to experience a sudden increase in the renewable energy sources' significance for the economy. Electricity generation capacities based on renewable energy sources will increase, in most cases, even several dozen times. Then, it is estimated that renewable energies produce five times more jobs than the generation of traditional energy.

Nevertheless, the current economic crisis has had an immediate impact which also affects manpower. After the boom of the early 2000s, there was a significant slowdown in 2008 in **Spain** and later in **Italy** (above all in relation to solar activity and the fall of incentives). Many companies found it hard to maintain their workforces and to create jobs, particularly those of a smaller size.

To this purpose, all the Spanish and Italian experts interviewed agreed that an increase in investment will be a key factor for the creation of jobs in the sector, the lack of which is one of the reasons for the slowdown in activity in the renewable energy sector.

3.3. Training needs in the sector

Taking into account the above considerations and significant shortages of qualified staff in these fields, it is necessary to take steps to fill the competence gap in the renewable energy sector.

In view of the open labour market across the European Union, and the calculations by the European Commission, according to which at present there are about 550 thousand people working for the renewable energy sector within the EU, and in 2020 the number is expected to reach more than 1.5 million, it should be noted that the key issue seems to be the development of training courses related to renewable energy sources.

In **Spain**, for instance, there is no specific program in relation to renewable energy within the official education system consisting of a full training schedule. What exist are different subjects taught at different levels (both in professional training and university courses).
According to the experts interviewed, training needs in the sector are covered by the existing supply. Large enterprises use their own training plans in accordance with the needs of their personnel. They plan training schedules and the training provided is in relation to both the subjects in connection with each work position (with the knowledge required for optimum performance), and occupational health and safety, an extremely important issue in the sector.

Professional training provided under the educational system is organised in:

- The specific professional modules of the initial vocational qualification programs.
- The middle-level training cycles.
- The higher-level training cycles.
- Specialisation courses (regulations pending publication).

These courses in Spain should comprise a professional profile, are structured in professional modules of varying durations and are organised in a manner which enables participants to learn about other activities and responsibilities too. There are currently 150 courses organised in 26 professional families at either middle or higher level. Middle-level courses award a technician's diploma and upper-level courses a senior technician´s diploma.

The official vocational training system includes upper-level diplomas in the professional family of energy and water, such as the Senior Power Plant Technician, the Senior Energy Efficiency and Thermal Solar Energy Technician and the Senior Renewable Energies Technician. There are no middle-cycle courses for this professional family.
Among the courses related to the renewable energy sector are those teaching the professional family of installation and maintenance, in the middle-level (as for the Heat Producting Installation Technician, the Cold Storage and HVAC Installation Technician and the Electro-mechanical Maintenance Technician) and upper-level positions (the Senior Project Development and Thermal and Fluids Installation Technician, the Senior Thermal and Fluids Installation Maintenance Technician and the Senior Industrial Mecatronics Technician).

With regard to university courses related to the renewable energy sector, the following are some of the diplomas offered by Spanish universities today:

- Graduate in Environmental Sciences.
- Graduate in Environmental Engineering.
- Graduate in Renewable Energy Engineering.
- Graduate in Energy Resource Engineering.
- Graduate in Energy Resources and Mining.
- MSc in Environmental Change Analysis.
- MSC in Automation and Telecontrol for the Management of Water and Energy Resources.
- Electronics Engineer.

In **Germany**, development of the branch is supported by "professional specialists" who have further developed their qualifications in a specific branch and have simultaneously gained relevant experience in the respective field of business. By way of contrast, a "specialised professional" does not necessarily have specific knowledge of the branch to begin with, but they instead begin working based on primary qualifications gained outside of the branch and then

rapidly qualify themselves in technical and occupational knowledge within the work process[11]. A current discussion is concerned with whether it would be possible for this sector to implement its own vocational training or whether the "established" training combined with modular further training as necessary would suffice for performing work. Yet at the moment, the following is routine in the renewable energy branch: modular VET and qualification is the order of the day and a difference is only made between formal, certified VET and VET within the work process. This is the case independent of workplace requirements. Work experience in the energy sector or work experience in general is an advantage in the sector since specific apprenticeship trades simply do not exist.

In general, there are state requirements regarding specific activities which may not be performed without certification of VET: this includes modular VET on protective equipment or occupational safety.

Large companies have their own VET programs for the most part but many VET institutions also offer courses for which completed vocational training is generally required for access. The range of VET courses from external bodies and their certifications is quite varied at the moment which means that both the title and content of VET can be confusing for an employer. A standardised method does not exist.

In the case of **Poland**, analysis shows that at the present the Polish labour market has very few specialists in the field of renewable energy sources. The study reports, in particular, the following professions, with the relevant qualifications to be completed:

- RES equipment installer.
- RES equipment and systems technician.
- RES equipment maintenance employee.
- RES installation designer.
- RES equipment sales representative.
- Environmental educator.
- Environmental Inspector.
- Countryside ranger.

Thus, it is of key importance to develop training programmes and educational institutions which will ensure the occurrence of specialists in this field on the labour market.

In **Italy**, given the complex but solid regulation framework, one of the foremost obstacles towards changes resides in the nature of demand and supply of the so called green jobs. It is often noted that there still exists a diffused feeling of indecision on the new professions, the relevant competences and the formal requisites, the dimension of the genre, future tendencies of training and occupational skills in the green sector in the long-run (post 2020). An example of this, with reference to the renewable energy sector, is the fact that while large firms are aware of their own individual requirements, rarely do they find people who are capable of fulfilling their needs: the world of education and training often gives fragmented and partially adequate geographical knowledge, which is not prompt to respond to the needs of green firms. On the other hand, small and medium sized enterprises, crushed by the demands of EU standards, often have to face the same communication difficulties with the sectors responsible of training workers for green jobs. On the other hand, workers, particularly young ones, invest in post graduate

[11] See Kleiss/Stube(2005) Arbeitsplatzsituation in einem Industrieunternehemen der Solarenergiebranche; in: Wissenschaftsladen 2005, p. 34-36

degrees and specialization courses that offer curricula that is often designed 'on paper', but which do not take into consideration the needs of the international 'green' market. The older labour force find opportunities for requalification or adaptation of existing work skills, hard to come by, especially during this period of slow emergence from economic crisis, even if such opportunities are at hand. Women, despite excellent good work practice, seem still today little interested and inclined towards the range of professional profiles within the sector.

To this end, the most pressing and immediate problem associated with professional relations within the green jobs sector remains that between the demand and labour supply. Today, this rapprochement between demand and supply occurs along 'static' lines, inadequate both at green job level, as well as, the labour market in general.

Professional training, when integrated with jobs, organized holistically and with the aim of providing occupational mobility through learning, contributes towards the alleviation of problems of misalignment between labour demand and labour supply responding therefore to the immediate demands of the market itself.

Faced by a complexity normative framework on both the national and European level, both in Italy and abroad, the lack of a common strategy aimed at guaranteeing the availability of a professional training for green jobs is apparent. Furthermore, there also exists the danger of the so called "green washing", or rather the superficial adaptation of jobs, which does not actually result in their training in substance.

Nonetheless, the rosy prospects, more often than not, remain solely on paper if firms which offer green job proposals are not informed as to how to satisfy their needs, while workers do not understand how to reply to such requirements.

Pertaining to new sectors, the start up phase of new green firms is often obstructed by the lack of or the inaccuracy of the training available. An example of this is the lack of web portals dealing with recruitment in the green jobs sector that have developed lately, which are still very few and fail to give accurate and complete training.

On the other hand, recruitment agencies, job counseling services, inter-professional organizations and trade unions, have had to rapidly adapt and equip themselves to understand the proper requirements of this market with regards to firms that have either fallen behind with their training proposals or professional content. This has not always been an easy task, both due to the international dimension and the ever-changing nature and control of such markets.

In a similar context, it is of crucial importance to clearly define the terms of competences of the emerging professional content, its characteristics and prerequisites.
The importance of considering the content of such professions, not just from a job title perspective, emerges from the simple observation of the objective difficulties associated with the diverse denominations of the meaning of green professions. The Site Manager, for instance, is addressed with different job titles in different firms, even if the professional profile remains a managerial one.

Many professional figures in the green economy will be characterized by a specific mix of skills, not altogether new; a knowledge of the"system" (specific knowledge pertaining to the country, the market sector, etc.,), as well as linguistic and communication skills, negotiation techniques, legal knowledge, and technical specialization.

As well as the above, other so called traditional 'soft' skills constitute the core of green professions; strategic capacity and leadership skills, entrepreneurial skills, adaptation and the impartation of knowledge, analysis and risk assessment, work group coordination skills, project management and efficient financial planning skills. An example of this refers to the necessary skills for employment in the photovoltaic field. Here, degrees with an engineering background seem to be sufficient enough, just as would a post graduate degree in the field of renewable energies. This type of training may prepare, for example, designers of photovoltaic plants in the future both in the private and the public sectors, as well as engineers and architects who would be in a position to correctly address the task of installation technicians.

Furthermore, whoever would like to opt for a job in a more technical field and learn to install PV cells would benefit from choosing to train initially as either electrician or surveyor (a qualified electrician is in fact necessary to attach PV cells to the main grid system), and thereafter specialise training courses with certified providers or regional authorities.

A professional installer should have in his/her repertoire the knowledge of setting up photovoltaic cells and the ability to provide for their maintenance, the knowledge of respective technical rules of the systems themselves as well as the legislation regarding incentives.

Possible difficulties with reference to the access of training

The difficulties associated with finding suitable candidates for green professions could also be motivated from the lack of the readiness to accept a professional profile which is still considered a work in progress, stratified, articulated and which puts in jeopardy traditional skills in view of revised competences of the new scenario.

Actual examples of unsatisfied professional requirements are in the eolic sector, which have recently benefitted from great developments. Despite the fact that it is foreseen that this sector can produce potentially 20 million job opportunities worldwide by 2030, firms already speak of a shrinking labour force.

The strong growth of this sector, which has risen over the period 2000 – 2007, has led to a multiplication of job opportunities in ancillary sectors, such as, for example, the manufacturing and the induced development industries. The lack of labour force is found primarily in two types of occupations; on one side, in the engineering division, and on the other, in the operation and maintenance field, as well as management activities of wind farms.

These professional profiles require a high level of education and a long period of work experience in this sector.

Another professional profile in high demand, not only in the eolic sector but generally in the renewable sector, is surely that of project managers. This figure is responsible for obtaining the necessary national permits where the wind farm is to be situated, and must have a mixed bag of knowledge relating to judicial know-how, economics, environment, technical ability, and language and communication skills.

In general, the lack of specialized technicians, installers and engineers for the renewable sector has become apparent. A lot of these mentioned profiles could be easily adapted from the construction sector.

For those previously employed in the construction industry, and who are today unemployed due to the economic crisis, green jobs could possibly represent a source of job re-location, after a brief period of 'on-the-job' training pertaining to the technical aspects of the sector, adequate training and complete understanding of the necessary health and safety requirements. The key problem therefore seems to be, not the lack of skills required for green jobs, in as much as the correct and clear interpretation and the reading of the requirements of the green sector itself. If on the one hand, there are jobs that can be clearly labelled as "green" (such as wind turbine designers), there is also the need for customisation in a green sense (greening) of the existing labour force (not only with respect to jobs with a strictly green profile such as installers, technicians and managers but also in the training sector with regards to coaching and correlated services).

While it is clear that specific differences can be identified in these emerging sectors, the difficulty in understanding the professional and formative requirements originates from the lack of ample dialogue and integration about training the labour market.

Beyond the conflicting names given to the same professional profiles and the translations from one language to another, the gaps between demand and supply for labour become greater with the movement from one firm to another changing; the firm's ethos, the organization of labour, production processes and probably even the collective contracts.

In general, many of the firms in the green sector express the need of remodeling altogether training plans, paths towards the development of skills, updating skills and training procedures to guarantee, as much as possible, an adherence to the necessary requirements of the industry, which are often left unfulfilled.

More specifically the requirements of the sector concern the timing of the changes themselves. An example of which is that on the opening of a photovoltaic panel production plant, estimates on productivity beyond a five year period already take into consideration technological changes and thus, the updating of the skills of the plant's workforce.

As a result of this changing scenario, it has become necessary to support the training of professional figures in a way that facilitates, on one hand, the entrance of young people into the labour market, and on the other, the relocation of people already employed (as well as those currently unemployed) through the renewal and readjustment of existing tasks in accordance with new specifications and requirements inherent in the ongoing mutation of the technological and productive processes connected with energy efficiency and the RES in general.

To this end it has become of crucial importance to support action aimed at professional training in order to operate, for instance, within sectors whose aim is to measure efficiency. As a consequence it has thus become necessary to activate finalized training policies, on one hand, aimed at the re-qualification of professional figures and thus, the creation of new competences; and on the other, the conversion of professional figures and thus, the creation of new job profiles. In this sense it is of fundamental importance that a joint effort is made with the aim of coordinating training programmes in such a functional manner so as to ensure policies that promote the development of energy efficiency, thereby facilitating the transfer of work practices and system training between markets and the productive sector.

The areas requiring major attention in terms of planning of effective training activities are:

- Paths of medium-high profiles within the educational system, which are key to the needs for individuals wanting to enter the market, but also for people requiring greater stability within the market itself (meaning in terms of contract stability as well as qualifications within the market) and which support the professional figures of both high and low profile themselves (engineers and biologists such as installers and maintenance personnel).

- The area of professional training, which relates not only to the insertion of young people into the labour market but also the regaining of the minimum school leaving requirement.

- The learning by doing concept, as a means of gaining and building skills within the work environment, is a key component in the conversion towards new professional figures and puts on the main agenda the question of the certification of competences.

The development of teaching and training are a definitive and fundamental feature to gain new skills for workers at all levels and also an important aspect in consolidating the transitional role with respect to the changes in occupations wherein lie the proper qualifications pertaining to the technological innovation associated with the green economy for the benefit of the economy itself, the environment and the labour market.

Summarizing, the ideal qualification and competence profile of a trained professional within the field of renewable energy is essentially made up of the following components: the foundation has been and will remain in the foreseeable future classic certain extent, conventional occupations and firms have started to develop new activities and business segments that make use of renewable energies, albeit with a constant increase of requirements specific to that branch.

The high rate of technical innovation is coupled with the constant development of new forms of installations and uses which above all creates demanding positions for particularly qualified specialists.

4. Recognition of qualifications: experiences in the sector

4.1. The system of recognition of competence

The recognition of qualifications of workers from the energy sector, including that of renewable energy, is a step which is necessary to maintain and increase the efficiency of companies in the sector, and to improve the social and labour situation of the workers involved.
In fact, it is well known that, especially for low and semi-skilled workers, the recognition of experience and non/informal training is a key opportunity for professional development. But, non-formal and informal gained competences are still widely viewed as less important by those involved in policy and practice. Little use is made of competences acquired informally (including commitment to social and community service) for the purposes of the formal education system (admission procedures, training and study programmes, certification at upper secondary level and in higher education).

Workers from the renewable energy sector have different training and educational programs at their disposal as a means of achieving maximum qualifications in a formal manner. The recognition of the qualification achieved implies the need for an officially established procedure and one which may be used to ensure this recognition is effective, regardless of the manner in which this qualification has been "achieved".

This is particularly the case for countries with a higly formalised vocational training system, such as Germany and Italy, where it is stressed that the term "recognition" means both "acknowledgement" and "acceptance", which implies that both documentation and certification are comprised in one term.

Although experts in the partner countries agree on the increasing necessity to develop mechanisms and instruments to recognise non-formal and informal gained competences, there still are differences in the countries, yet. Furthermore, it is highly doubted that there are sufficient ways of recognize and accredit skills and competences gained through these learning ways at the given time. Informal and non-formal learning recognition has to be valid and feasible, it has to add value to the company and be easily understandable and cost-effective.

Nevertheless, the discussion about the recognition of non-formal and informal learning is carried out for years now with inclusion of experts, educational providers, social partners, politicians – and the matter will not disappear, but become more and more relevant due to a shortage of skilled workers and demographic change.

In the partner countries different innovative concepts are developed and tested to explore new approaches and to find a solution to the matter.

In **Spain**, Royal Decree 1224 enacted on July 17th 2009 sets forth the guidelines to be developed in specific regulations, establishing the procedure and requirements for the assessment and accreditation of the professional skills acquired by people through work experience or non-formal training activities.

The purpose of the same is to establish the procedure and the requirements for the assessment and accreditation of professional skills acquired by individuals through work experience or non-formal training activities, in addition to the effects of this assessment and the accreditation of skills. The said procedure is valid throughout Spain.

The procedure for the assessment and accreditation of professional skills shall mean the set of actions geared to assess and acknowledge skills acquired through work experience or non-formal training activities.

The purposes of the procedure are:

- To assess the professional skills of individuals acquired through work experience or non-formal training activities using common procedures and methodologies which guarantee the validity, reliability, objectivity and technical rigour of the assessment.

- To officially accredit the professional skills, promoting the value of the same with the aim of facilitating insertion, integration and free circulation in the employment market, and personal and professional progress.

- To help people gain access to lifelong learning and to obtain further professional qualifications, providing opportunities for obtaining partial cumulative accreditation, with the aim of concluding training leading to the award of a vocational training diploma or a certificate of professional standards.

The procedure shall be subject to the principles of respect for individual rights, reliability, validity, objectivity, participation, quality and coordination. The assessment and accreditation shall be based on the skills listed in the National Catalogue of Professional Qualifications included under vocational training diplomas and/or certificates of professional standards.

The assessment of professional skills by a given authority shall be based on professional achievements, performance criteria, and the professional context of each of the same, in accordance with the criteria set in the corresponding guidelines. Each competence unit shall be the minimum accreditation unit.

The pertinent administrations shall guarantee an open and permanent service to provide information and guidance to anyone requesting the same, on the nature and phases of the procedure, the requirements for accessing the same, their rights and obligations, the official accreditations available, and the effects of the same.

Regarding recognition in **Germany**, although a series of parallel procedures exist which are anchored in law and associated with formal recognition, a central system based on uniform legislative provisions for the recognition of non-formally and informally acquired competences does not exist yet.

Instead, developments have mostly focused on the acknowledgement of non-formal and informal learning and its evaluation as an essential pre-requisite for recognition.

A study conducted by the German Federal Ministry of Education and Research (BMBF 2004) discovered that in 2003, a total of 51 different forms of passports were available to record competences and informal learning. These passports are intended to document qualifications and activities which play a role in recruitment and further professional development.

In addition to these effective procedures in the education system and on the labour market and also to programmes initiated under education policy, there are arrangements under collectively agreed settlements and company procedures that are applied on the labour market but are not associated with admission into the education system and formal recognition[12]. Unfortunately, no example was provided regarding the renewable energy sector and unskilled and semi-skilled workers yet the procedures explained below could also apply to this sector.

Existing approaches at a political level have a comparatively narrow scope. An essential cause of the comparatively low significance of formal recognition of informally and non-formally acquired competences appears to be rooted in the German system of vocational training and VET itself, which is largely integrated with the employment system and provides for progressive vocational development.

It should be noted that in workplace practice, competences acquired by nonformal and informal means are taken into account beyond certification.

In **Italy** all procedures, systems and models of experience validation developed a spontaneous and unstructured system (not only at regional level, but also in specific and limited national arrangements) with different purposes, approaches and methods. The heterogeneity of the

[12] Federal Ministry of Education and Research, BMBF (Hrsg.)(2008): Status of Recognition of non-formal and informal learning in Germany, Bonn, p. 13

Italian experience, both in the public/institutional sector and in the private sector, has led to the consequent difficulty of relying on unique and shared rules and procedures.

The process of transfer and validation of non-formal and informal learning can be managed by a variety of players and institutions (e.g. Regional and provincial administrations) and educational organizations (schools, training agencies, universities) but also firms, employment centers or private agencies dealing with matching labour supply and demand, as well as non-profit organizations, voluntary organizations and non-governmental organizations.

In some cases, participants in charge of management and those in charge of validation are the same, in other cases they are different (e.g. the process manager may be a Training Agency, while a commission of experts appointed by a regional administration may be in charge of the validation process).

Under all circumstances, in order to better manage the validation procedure (either as managers or validators), the participants must be homogenous and share the same procedures and rules.

Over the last three years, Italian institutions have strongly promoted the concepts of recognition and validation of learning outcomes achieved outside the context of formal education and training. This has a strong connection with the economic crisis and highlights the need to improve and upgrade the skills of individuals who are facing increasingly uncertainty in the labour market. As a consequence of the increasing gap between demand and supply of skills, the issue regarding the maintenance and enhancement of skills has gained priority in the political and institutional agendas. In this regard, it is necessary to ensure effective integration between services and usability of local skills, achieved to the extent that all stakeholders that represent each sub-system (institutional, trade unions, private parties involved in the development of human resources) will share a common project. However, the available data proves that, despite the number of networks in the territory and willingness to cooperate, there is still a limited capacity in this direction. In terms of certification of skills, the creation of a national system based on uniform standards across the country is making slow headway, while the models and practices defined by the regions are better and more detailed.

To this purpose, in line with the recommendations of the European Union and in accordance with Law 92/2012, Italy adopted the Agreement on Lifelong Learning and ratified the Agreement on permanent job counselling. As specific regulation of this matter, the Legislative Decree of January 16, 2013 n. 13 "Definition of the general rules and the basic levels of performance for the identification and validation of non-formal and informal learning and the minimum service standards of the national skills certification" contain:

- A definitional and shared framework on this matter.
- Standard minimum benchmarks for the regulation and service delivery validation and certification of competences.
- The establishment of the national framework of evidence of education and training and qualifications (accessible and available electronically).
- The standards of the credentials and certificates that can be used at European level.
- A monitoring and evaluation system to implement the provisions of the decree.

At the local level, Italian regions are about to adopt a system of qualifications in order to tidy up and streamline the release of diplomas and certificates.

At a glance, we can say that, similarly to the rest of the EU, all the Italian Regions have started actions and initiatives to enhance and affirm the principle of certification of learning at all levels. More established and operational systems include regulatory standards for the recognition of credits.

Anyway, the Italian system has worked in recent years to overcome the fragmentation and lack of integration that characterizes the training-educational-professional scenario. Good practices have been carried out by single regions at experimental level. For instance, the Region of Valle d'Aosta is experimenting the adoption of the Citizen's Training Booklet, which is a good example of how an "institutionalized validation" process of individual skills takes shape through verification according to specific methodological standards and processes.

4.2. Some examples of the certification of competence in the sector

Spain

There is an official approved procedure in Spain, Royal Decree 1224/2009, dated 17 July, which recognises professional skills acquired through work experience.This procedure defines the agenda and steps to follow in order to validate and turn such recognition official.

This procedure comprises three phases:

- Guidance. Mandatory and may be individual or collective in accordance with the characteristics of the notice and the procedure, and the needs of the applicants.

- Assessment of professional skills. The purpose of this assessment shall be to prove the existence of the professional skills required at the levels defined in the achievement criteria, and the work situation defined, real or simulated, based on the professional context. The methods regarded as appropriate shall be used: observation of the applicant in the workplace, simulations, standard professional skills tests, personal interview, etc.

- Accreditation and registration of the professional skills. Those who pass the assessment process will be awarded a certificate for each of the competences units in which professional skills have been shown.

- The recognition of the professional skills acquired through work experience is conducted by the Regions within the corresponding regional scope of the same, although this recognition applies to all of Spain. In other words, a certain competence may be recognised in Galicia, but it is valid in Cataluña, Madrid, etc.

The corresponding authorities hold public convocations, defining the competences or competences units to be recognised, the timeframes involved, the training activities of the different entities entrusted with conducting the procedure, the different tools to be used, etc.

Germany

a) Procedures in the vocational training

Recognition of informal competences by means of an external students' examination[13]. Admission to an examination within the framework of external regulations is aimed primarily at unskilled and semi-skilled workers to allow them to gain vocational qualifications, which means obtaining formal acknowledgement in order to find employment in the renewable energy sector since it is most often trained professionals who are recruited as the trend towards unskilled workers dwindles.
Regulations concerning participation in external students' examinations according to § 45 (2) BBiG (Vocational Training Act) and § 37 (2) HwO (Crafts Code) follow: the candidate must have sufficient work experience which corresponds to 1.5 times the duration of training for a standard vocation, meaning approximately 5 years. The minimum period of time may be waived if the candidate can demonstrate that he/she has acquired vocational competence that justifies admission to the examination. Training periods in another relevant apprenticeship trade also count as periods of employment.

Those without documentation of the competences they have informally acquired cannot be admitted to an external students' examination. In the future, procedures to ascertain competences must be developed which can document such informal competences. Only then will it be possible for this target group to have access to external students' examinations.

b) Steps and programmes to prepare for recognition
Procedures exist that are only partially legally regulated which appreciate or recognise informal learning. This applies particularly when companies accord certified qualifications and competences only limited significance in staff selection and are unable to recruit sufficient junior staff from formal and non-formal educational pathways.

ProfilPASS. ProfilPASS is an instrument which allows individuals to illustrate the competences acquired throughout their biography based on self-assessment. This is performed with guidance from trained advisors in eight proposed fields of activity. In this process, special attention is given to informally acquired competences. The result of the process is an individual record of competences as a starting point for further activities. The ProfilPASS system is composed of the "ProfilPASS" instrument and an advisory system which is coordinated to the instrument that, inter alia, proceeds in a biographical manner.

Effective recognition of work experience by means of collective agreements. The conclusion of collective agreements offers a possibility for recognising work experience and competences. Social partners have established regulations within collective agreements in some branches and occupational groups. Experience is then equated with a vocational qualification which translates into the adjustment of salary groups. For example, an employee in salary group 1 is then reclassified based on experience which begins in salary group 1.1 and increases to 1.2, 1.3[14].

Italy

In Italy, educational and professional qualifications consist of school diplomas or professional qualifications that are regulated by professional guilds or associations. The renewable energy sector, as an innovative sector, could suffer from the difficulty of obtaining recognition for its

[13] More information see: http://www.perspektive-berufsabschluss.de/de/501.php
[14] In the "collective agreement remuneration framework (ERA-TV)" of the metal and electrical industry in Baden-Wurttemberg, the classification under the collective agreement relates to the duties of the job. In accordance, it is immaterial how the necessary skills, knowledge and abilities were acquired. Instead, the key competences efficiency, quality, flexibility, responsible behaviour, co-operation and leadership are recorded.

skills from both systems, from legal stand point, and a slow and complex updating mechanism. In addition, constraints to exercise certain professions arise frequently due to some professional associations (such as the order of Engineers, for example) which not facilitate access to innovative professional activities[15].
Qualifications, however, are identified both at the national and regional level. What can be done at the national level is then "contextualized" by the regions according to their own needs[16].

In addition, the recognition of skills can be of public institutional value or private and market value. In the first case, the competent authorities for the recognition of skills are the educational and training institutions (Schools, Universities and Regions) or the institutions that recognize professional qualifications (Ministries, Professional Orders/Guilds). Outside the institutions, an officially approved certificate can be released by the respective associations or confederations of firms of a particular sector. This second approach has proved to be successful in all innovative sectors.

In the energy sector there are still very few examples, usually relating to projects in Europe, for the development of specific skills. In fact, a technical operator or electrician should also acquire the skills of a photovoltaic installer, similarly a heating and plumbing technician should acquire all the skills relating to solar, biomass, geothermal, and of geothermal energy. Italy is working on this integration within the Build up skills-Italy project (www.buildupskills-italy.enea.it).

ENEA (the Italian National Agency for New Technologies, Energy and Environment), for example, through the QualiCert (www.qualicert.enea.it) and Compener projects (www.compener.enea.it) has developed a "knowledge, skills and competences" card based on the European Framework of qualifications for the following professionals:

- Solar thermal plants installer.
- Photovoltaic systems installer.
- Biomass plants installer.
- Heat pump systems installer.
- Low enthalpy geothermal systems installer.
- Small wind turbines installer.
- Trainers of small-scale renewable energy plants installers.
- Energy managers.

As far as construction professionals working in the energy efficiency field are concerned, there are also plans to develop similar competences cards to update the following professionals: carpenters, bricklayers, plumbers, electricians, automation experts, etc.

In this context the role played by all those competent institutions concerned with the recognition of competences in the field of renewable energy is very important:

- For example, education and training institutions will play a major role in setting up the appropriate training proposals in this area in order to promote employability and the demand for skills;

[15] Dr. E. Perulli, Researcher Isfol (Italy) – Area Systems and Methodologies for Learning, on of the experts interviewed whitin the project.
[16] Dr. A. Moreno, Head of Training and Information Service at the ENEA Research Center, National Co-ordinator for the project BUILD UP SKILLS relating to the qualification of the professionals in energy efficiency in buildings.

- In the case of other institutions (e.g. the Ministry of Environment or Productive Activities) can regulate professions and establish forms of certification and/or quality control for those who are employed in this sector.

The role assigned to the institutions concerning the approval of skills required to work in the renewable energy sector should also include the following steps:

- Agreeing on the EQF cards.
- Adapting the current systems to the new cards.
- Establishing a simple strategy based on the learning outcomes to be achieved.
- Training the instructors, making sure they are up-to-date at a National/European level in order to ensure homogeneity.
- Form / update workers / professionals on the basis of what is being shared.
- Build a single registry of skilled workers/professionals.

The advantages of such recognition are manifold: from a socio-economic point of view, recognizing the knowledge that can be acquired outside traditionally dedicated institutions (schools and universities) supports the competitiveness of the system and the flexibility of career paths. This could also facilitate re-entry in training through a mechanism of credits, facilitate geographical and occupational mobility, and help to break down barriers to access the labour market. To achieve this goal, however, a major cultural change needs to take place in terms of procedures and practices observed by all educational institutions, training organizations or business activities. In essence, a radical change of mentality is needed, without which this would only remain a hypothesis in Italy.

Poland

In the absence of implementation of the EU requirements regarding training and qualifications of the RES sector employees, the current professional qualifications are certified by:

- Professional electrician licenses.
- Post-graduate study courses and training courses in the field of RES.

Professional electrician licenses

The Act of 10 April 1997 on Energy Law (Journal of Laws of 2003, No. 153, item 1504 (consolidated text) requires all persons involved in the operation of electrical power networks, devices and installations to have relevant qualification certificates issued by a qualification committee. The qualification committees are appointed by the President of the Energy Regulatory Office. According to the Regulation of the Minister of Economy, Labour and Social Policy of 28 April 2003 laying down detailed rules of certifying qualifications of persons involved in the operation of electrical power networks, devices and systems; the qualification committees are established:

- In companies which employ at least 200 persons carrying out the tasks referred to in Article 5 paragraph 1,
- Within scientific and technical associations, if their statutes contain provisions which determine the scope of activities performed for the energy-related sector; and within units subordinate to relevant ministers or heads of the agencies referred to in Art. 54 paragraphs 2 and 3 of the Act of 10 April 1997 – the Energy Law.
- The associations which carry out relevant courses and qualifying examinations include:

- Association of Polish Electrical Engineers (www.sep.com.pl)
- National Association of Power Engineers (www.spe.org.pl)
- Polish Association of Mechanical Engineers (www.simp.pl).

These associations have qualification committees appointed by the President of the Energy Regulatory Office and having with full powers to run examinations in the following areas:

- Networks, devices and installations which generate, transmit or consume electricity:

  1. Generator units connected to the power national grid, regardless of their nominal voltage.
  2. Networks, devices and installations with voltage up to 1 kV.
  3. Networks, devices and installations with nominal voltage over 1 kV.
  4. Generating units with power over 50kW.
  5. Electrothermal devices.
  6. Electrolysis units.
  7. Street lighting systems.
  8. Overhead power lines for means of transport.
  9. Explosion-proof electrical equipment.
  10. Control and measurement devices, and automatic control and protection devices for equipment and systems indicated in points 1 through 9.

- Devices which generate, process, transmit and consume heat, and other energy-related devices:

  1. Steam and water boilers using solid, liquid and gas fuels, with power over 50 kW, together with auxiliary equipment.
  2. Heat networks and systems together with auxiliary equipment, with heat transmission over 50 Kw.
  3. Water and steam turbines with power over 50 kW, together with auxiliary equipment.
  4. Industrial devices receiving steam and hot water, with power over 50 kW.
  5. Ventilation, air-conditioning and refrigeration devices with power over 50 kW.
  6. Pumps, exhaust fans, ventilators and fans with power over 50 Kw.
  7. Compressors with power over 20 kW and compressed air systems and industrial gas systems.
  8. Fuel loading, storage and unloading devices, with a storage capacity corresponding to mass over 100 Mg.
  9. Industrial furnaces with power over 50 Kw.
  10. Control and measurement devices and automatic control devices for equipment and systems indicated in points 1 through 9.

- Devices, systems and networks which generate, process, transmit, store and consume gaseous fuels:

  1. Devices for gaseous fuel production; gas generators.
  2. Devices for processing and treatment of gaseous fuels; fanning systems for gaseous fuels, natural gas processing equipment, gas purification devices, liquid gas decompression and bottling devices, nitrogen removal plants, mixing devices.
  3. Equipment for gaseous fuel storage.
  4. Gas transmission networks with pressure over 0.5 MPa (gas pipelines, gas stations, gas compressor stations).

5. Gas distribution networks with pressure over 0.5 MPa (gas pipelines, gas stations, gas compressor stations).
6. Gas devices, systems and appliances with pressure not exceeding 5 kPa.
7. Gas devices, systems and appliances with pressure over 5 kPa.
8. Industrial-scale gaseous fuel receiving units with power 50 Kw.
9. Gas turbines.
10. Control and measurement devices, and automatic control devices for networks, devices and systems indicated in points 1 through 9.

Specific ranges and types of devices in the above-mentioned groups are determined in the Regulation of the Minister of Economy, Labour and Social Policy of 28 April 2003 laying down detailed rules of certifying qualifications of persons involved in the operation of devices, systems and networks (Journal of Laws of 21 May 2003).
All persons engaged in the operation of devices from each of the above-mentioned groups have to have a qualification certificate corresponding to the type of equipment operated and the type of work done. Work with the individual types of devices is described as work in the field of the devices' operation, maintenance, repair, control, measurement and assembly. Depending on whether a specific person directly performs the above-mentioned works, or manages the performance of those works by other persons, he/she a relevant license for their performance or supervision.

There are the following groups of positions:

- Supervision positions – positions of technical personnel and other persons in charge of activities of personnel performing tasks in the fields of operation, maintenance, repair, control, measurement and installation; and jobs of persons supervising the operation of devices, systems and networks.

- Operational positions - positions of personnel performing tasks in the fields of operation, maintenance, repair, control, measurement and installation.

- Post-graduate study courses and training in the field of RES.

Post-graduate study courses in the field of renewable energy sources are offered by numerous universities and institutions, both public and private ones. The main objective of those courses is to pass knowledge about renewable energy sources, in particular to explain the individual types of renewable energy sources, to teach how to design and select devices depending on specific conditions, and to explain legal and financial instruments applicable to investments in the field of RES. The curses aim to pass knowledge about renewable energy sources to persons without earlier experience in this sector, or to update their knowledge about the latest achievements and trends in the sector.

Those types of post-graduate study courses, depending on the scope of the curriculum, can be addressed to:

- Mid-level managers – persons who manage project teams or are going to be responsible for the implementation of investment projects in the future.
- Representatives of development companies from the sector of renewable energy sources.
- Representatives of the conventional energy sector.

- Representatives of financial institutions participating in investment projects in the renewable energy sector.
- Representatives of small and medium-sized enterprises involved in energy-related investment projects.
- Representatives of local government units responsible for energy strategy development and implementation.

Graduates of such postgraduate study courses, thanks to the gained knowledge can find employment on various positions depending on their preferences, skills and previous experience. The possible jobs include positions in the field of design and management in the private or public sector (both local-level government units and national-level government bodies), as well as in the field of scientific research.

Study graduate courses are paid, and last between two and four semesters. Their successful completion is conditional upon the participation in all the classes, passing the individual subjects and the final examination to obtain the course diploma.

A formula slightly different to the postgraduate study courses are trainings and courses devoted to renewable energy sources. They are less demanding and less costly. They usually take the form of a series of meetings which last several hours. Their goal, depending on the curriculum, is to provide general information on renewable energy sources, information about the selected renewable energy technologies, to promote the use of RES and to develop pro-environmental attitudes with emphasis on the rational use and saving of energy. After completing a series of lectures and workshops, the participants receive certificates of participation in the training.

5. Conclusion

The energy policy is based on three main factors: the supply security, the preservation of the environment and the economic competitiveness. To achieve these objectives, one of the most important measures is to encourage the renewable energies.

Renewable energies are regarded as those derived from the sun, water, wind or vegetal and animal biomass. They do not use fossil fuels, as conventional energies do, but resources which are naturally renewed (hence the name) and inexhaustible. Their environmental impact is far less than that of fossil or nuclear energy, particularly in relation to the generation of greenhouse gases and radioactive waste.

Within the EU strategy of 2020, the expansion of renewable energies plays a major role.

In **Germany**, the renewable energy sector as the core of growth will surpass classic industries such as machine building and car manufacturing in terms of economic power and employment volume by 2020. The sector is well on its way of reaching the national goals of the EU strategy by 2020, as well as for other countries investigated in this study.

In **Spain**, talking about the installed power, wind energy is the most important, followed by photovoltaic solar energy.

In **France**, renewable energies appear an interesting alternative to the nuclear power for preserving both the comfort of humans and air quality. Here companies seeking human resources

are mainly those working with photovoltaic, solar thermal and Heat pump, while investments in other domains (such as hydraulic, geothermal, biomass, waste and biogas) are smaller.

In **Poland**, even if the energy sector is based primarily on coal technologies (Poland is the largest producer of coal in the European Union), the share of energy sources in the overall "energy mix" is increasing, especially as concerns renewable energy sources. In fact, the support system for producers of energy from RES has aroused a large interest of domestic and international investors in this area. For examle, in 2011 Poland was the seventh fastest-growing wind energy market in Europe. A particularly high rate of growth in production and employment is seen in photovoltaics and wind power.

In **Italy**, investment dynamics show a strong market interest in renewable technologies for the production of electricity, with amazing results in terms of distribution and production in recent years.

However, these results had high financial costs which led to a crisis in this sector. The promotion in the use of renewable energies represents benefits for the countries: the generation of jobs; the need of professional qualitication; the application of high-technology; the development and implementation of R&D&I; the preservation of the environment; the harnessing of new, cleaner resources; manufacturing of components for industries from the energy sector, which would imply the commissioning of research programmes; and the emergency of new sources of employment.

There are common point profiles in the sector companies:

- Conventional energy companies or construction firms which have discovered renewable energy as a mean of diversifying their business.
- Recently-founded companies with a far lower number of employees.

As a common point among the countries, we can show the following workers' profile in the renewable sector:

- A predominance of men.
- The highest average age is that of workers involved in the activities of transportation, distribution and marketing of electrical energy, whilst in the activity of wind production and other types of energy, the average age is 25-35 years.
- A minimum percentage of workers are foreigners, and half of them come from countries outside the EU, except in the wind energy, where the higher number of workers comes from the EU.

Perspectives for the creation of jobs are focused on the the areas involved in logistic, management of factories, and R&D&I. It is generally estimated, due to an increase in labor needs in this sector, that there is a lack of professionals in the RES, which means that solutions must be strived for. However, the lack of investment in the sector may produce a fall in the jobs bigger than it is foreseen.

About the training needs of the workers in the sector there are some differences among the countries: while in Spain the current training offer covers the training needs widely, this is not the case of other countries. Very often, large enterprises have their own training plans to face the training needs which may arise among their workers unusually.

Anyway, the existing approaches and procedures have shown that the recognition of competences which have been acquired non-formally or informally can be of a substantial benefit for individuals, companies and society as a whole.

A procedure for the recognition of professional skills acquired through work experience is experienced throughout the countries in Europe but, while it is consolidated in countries such as Spain and France, in Italy it is still in progress.

At the same time, however, it becomes evident that in all the EU Member States (in the case of this study, above all in Germany, Italy and Poland) the potential has by far not been completely exploited. In practice, most of the existing procedures and approaches still play a small role.

Taking the experience of other countries into consideration, Germany, Italy and Poland still must forge their own paths, which have to be based on their national educational systems and legal principles and, which also have to be decisively supported by all relevant actors.

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Ademe Agence de l'environnement et de la maîtrise de l'énergie http://www.ademe.fr
AIE Agence internationale de l'énergie http://www.iea.org
Alpiq Alpiq énergie France http://www.alpiq.fr

Andra Agence nationale pour la gestion des déchets radioactifs http://www.andra.fr
CEA Commissariat à l'énergie atomique et aux énergies alternatives http://www.cea.fr
Ceren Centre d'études et de recherches économiques sur l'énergie http://www.ceren.fr
CFBP Comité français du butane et du propane http://www.cfbp.fr
Citepa Centre interprofessionnel technique d'études de la pollution atmosphérique http://www.citepa.org
CPDP Comité professionnel du pétrole http://www.cpdp.org
Credoc Centre de recherche pour l'étude et l'observation des conditions de vie http://www.credoc.fr
DGEC Direction générale de l'énergie et du climat http://www.developpement-durable.gouv.fr/-Energie-Air-et-Climat-Douanes /
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EDF-Groupe Électricité de France http://www.edf.fr
ERDF Électricité Réseau Distribution France http://www.erdfdistribution.fr
GDF-Suez GDF-Suez http://www.gazdefrance.fr
Insee Institut national de la statistique et des études économiques http://www.insee.fr
Observ'ER Observatoire des énergies renouvelables http://www.energies-renouvelables.org
RTE Réseau de transport d'électricité http://www.rte-france.com
Sfic Syndicat français de l'industrie cimentière http://www.infociments.fr
Shem Société hydro électrique du midi http://www.shem.fr
SNCU/Fedene Syndicat national du chauffage urbain et de la climatisation urbaine/ Fédération des services énergie environnement http://www.fedene.fr
Snet(E.ON France) Société nationale d'électricité thermique http://www.eon-france
MEDDTL - CGDD – SoeS http://www.stats.environnement.developpement-durable.gouv.fr
Insee - Direction de la coordination statistique et des relations internationals http://www.insee.fr
Site du premier ministre : www.gouvernement.fr/premier-ministre
Site du ministère en charge de développement durable: www.developpement-durable.gouv.fr/sndd

7. Glossary

Assessment - The structured process via which it is assessed whether or not the professional skills of an individual comply with the requirements and criteria specified in the National Catalogue of Professional Qualifications (CNCP).

Biogas -The generation of electrical energy using gas produced in landfills or slurry.

Biomass -This term covers a wide range of sources of energy from simple wood combustion for heat, to thermal plants for the production of electricity using forest, farming and livestock residue as fuel, and includes what is known as energy crops, such as landfill biogas and sewage sludge, or biofuels.The potential of energy derived from biomass is enormous.

Cogeneration - The simultaneous production of heat and electricity by means of steam turbines, gas turbines or internal combustion engines for the joint use of the same.

Economic sector - Four main groups of productive activity: agriculture, industry, construction and services.

Formal training routes - Training processes the content of which is explicitly geared to a program resulting in official accreditation.

Geothermal energy - Obtained by means of the use of the heat from the inside of the Earth for use in a range of applications including the generation of electricity, heating, cooling, and the production of hot sanitary water.

Greenhouse gases (GHG) - Basically carbon dioxide (CO2), methane (CH4), nitrogen oxides (NOx), and chlorofluorocarbons (CFCs). CO2 is the main gas (around 76%), but is not the most harmful. It is used as a reference when calculating emissions of the other gases. The relative effect of CFCs is 15,000 times greater and these gases register a 5% share in the greenhouse gas effect; CH4 is 25 times more harmful and registers a share of 13%; and the effect of NOx, responsible for around 6%, is 230 times greater than that of CO2.

GWh - A unit of energy equal to 1,000,000 Kwh. 1 Kwh is the energy generated by the power of 1Kw for one hour, equivalent to 3.6 million joules.

Hybridisation - The generation of electrical energy at a facility using fuels and/or technologies which use thermoelectric solar energy or biomass and biogas, in accordance with the terms of Royal Decree 661/2007.

Job placement - The work positions covered by a worker.The information is obtained from the notice or contract presented by the employer or directly from the worker.

Mini hydroelectric plant - Hydroelectric energy of less than 10 MW is regarded as renewable. These plants may have a certain environmental impact on headwaters, however if sites are selected carefully they are far less harmful than conventional power.
plants. It is obtained from the kinetic energy generated by a current of water flowing over different levels.

MW - A unit of power equal to 1,000 kW.

Non-formal training routes - Training processes not geared to official accreditation.

Occupation - A group of professional activities belonging to different positions with common characteristics, the tasks in relation to which are performed using similar regulations, techniques and means, and require the same level of qualification.

Ordinary regime - Legal-economic regime set forth in Law 57/1997 and amendments thereto, to which nuclear and thermoelectric power plants using fossil fuels (coal, natural gas and fuel-oil) are subject.

Photovoltaic solar energy - Obtained by transforming solar energy directly into electrical energy using photovoltaic panels.These panels capture sunlight for the generation of electricity. It is highly recommended for residences and facilities beyond the range of power lines.

Primary energy - Obtained directly from nature such as solar, hydro, wind, and biomass energy, or subsequent to an extraction process, as for example: oil, natural gas, coal, geo-energy or nuclear energy. It is measured in TOE (ton of oil equivalent).

Productive sector - Each of the groups of productive and corporate activities with common and individual characteristics and belonging to a specific economic sector.

Professional profile - Defines the skills an individual needs to master to perform a professional activity.

Professional qualification –It a set of professional competences significant for employment which can be acquird through vocational education and training (VET) modules or any other kind of learning structure as well as through work experience.

Professional skill -The set of knowledge and capacities which enables a worker to perform in accordance with production and employment requirements. These are included in the professional qualifications skills groups.

Reactive energy - Additional demand for energy consumed by certain equipment of an inductive nature (engines, transformers, lamps, etc).This energy is necessary for such equipment to operate, but does not produce an increase in its useful effect, reason for which energy efficiency drops if consumption is high.

Secondary energy/final energy -Refined energy suitable for all applications used by society:diesel fuel and petrol, soft coal and anthracite, piped natural gas, electricity, processed biomass and useful solar heat.

Special regime- Legal-economic regime set forth in Royal Decree 661/2007, to which electric power plants using renewable sources and/or cogeneration are subject.

Thermal solar energy -Consists of the use of energy from the sun to produce heat, steam and hot air.The most common uses of this technology are the heating of sanitary water, underfloor heating and the pre-heating of water for industrial processes.The use of solar panels to heat water (for industrial use, swimming pools, heating or most commonly for hot sanitary water) is a technique used both in the sector domestic sector and services and industry.

Ton of oil equivalent (TOE) -This is a unit of energy the value of which is equal to the energy provided by a ton of oil.It is based on a conventional value of 11,630 kW.A ktoe is this value multiplied by 1,000. As such, 1ktoe = 11,630,000 kW.

Wind energy - Harnesses the kinetic energy of the wind and converts the same into electricity. It may also be used for mechanical use (for example, water pumps). It is traditionally used at small-scale facilities, and often together with photovoltaic energy. It is converted into highly competitive energy at locations where the speed of the wind surpasses 6 metres per second. Countless wind farms have been constructed for the production of electricity on a large scale. One of the advantages of this type of energy is the fact it is an abundant, renewable and clean resource, thereby helping to reduce the emission of greenhouse gases.