RENEWED SKILLS

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Recognition of competences in the renewable energy sector in the EU

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Analysis of the social and labour situation in the renowable energy sector in Spain

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The impact of the economic crisis on society is of sufficient importance to imply the energy model needs to be changed, moving towards a sustainable economic system which is more respectful of the environment,uses sources of clean energy, and boasts a far more efficient and qualified production system than that in evidence today.

Furthermore, the economic crisis has led to a significant drop in real energy demand in Spain, causing problems for companies in the sector, including those which generate the said energy using raw materials which are regarded as cleaner.This context underlines the need for a serious and strict policy on how to regulate the energy market in Spain, as a means of ensuring this planning complies not only with political requirements (both of the EU and the Spanish government), but also with consumption requirements.

What is known as the renewable energy sector is not an economic activity in itself, but includes a wide range of activities:the production of elements, the creation and installation of systems, the production of energy in itself, distribution, transport, marketing, etc.

1.1.Introduction

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. The development of the same is a reality and an investment for the future.

Despite the current uncertainty with regard to all levels of the economy (global, European, national, regional and/or local) and the recovery of the same in the future, the energy sector is vital to economic recovery.In light of the uncertain perspectives in the sector, and 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.

As renewable energies are indigenous sources of energy, the introduction of the same increases supply security by reducing the importation of oil and its derivative products and natural gas, energy resources which Spain does not possess, and coal, an indigenous source of energy.

> The environmental impact of renewable energies is far less than that of fossil or nuclear energy, particularly in relation to the generation of greenhouse gases and radioactive waste.

The promotion of the use and development of renewable energies represents benefits for the country. 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.

Percentage of renewable energies over production in terms of primary energy		
	Primaryenergyproduction (ktoe)	
	2009	2010
Hydraulic	2.271	3.636
Wind	3.278	3.798
Biomass	4.493	4.853
Urbansolidwaste	319	216
Biogas	193	199
Biofuels (transport)	1.056	1.413
Geothermal	14	16
Photovoltaic solar	513	552
Thermoelectric solar	42	285
Lowtemperaturethermal solar	156	183
TOTAL RENEWABLE ENERGY	**12.334**	**15.150**
CONSUMPTION OF PRIMARY ENERGY(ktoe)	**129.764**	**130.134**
Renewableenergy/Primaryenergy (%)	**9.5%**	**11.6%**

Source: Energy in Spain 2011.State Secretariat for Energy.
Ministry of Industry, Energy and Tourism (MINETUR).IDEA data.

Research has been conducted in Spain to assess the potential of renewable energies:the compilation of a wind map; research conducted to assess the potential of biomass using a Geographic Information System[1]; research conducted on the different solar

[1] The Geographic Information System (SIG) is an integrated series of computer means and methods capable of collecting, verifying, storing, managing, updating, handling, recovering, processing, analysing, illustrating and transfering data specifically related to the Earth. (The National Geographic Institute, summarising the definition of the Department of the Environment, DoE, Burrough, Goodchild, Rhin and others).

technologies; and research on the energy potential of ocean waves (conducted at national level for the first time).These studies illustrate that the potential of renewable energies is far-reaching, and much greater than domestic demand for energy and existing fossil-based energy resources.They are in fact the country´s main energy asset.

The year 2011 saw an increase in the use of renewable energies in Spain in terms of installed potential or capacity.Despite this increase, a slight drop was registered in the electricity generated using these technologies.Consumption of primary energy of a renewable nature rose to 11.6%, around 0.3% more than in 2010. In terms of final energy, consumption of renewable energies increased to 15.9%, around 1.7% more than the previous year.The target defined in European Directive 2009/28/CE is 20% of final energy by 2020.

The table below illustrates production figures for the electrical areas in 2011.

Generation of renewable energy in 2011			
	Power (MW)	**Production (GWh)**	**Primary energy production (ktoe)[2]**
Hydraulic (>50MW)[3]	13.521	19.773	1.700
Hydraulic (between 10 and 50MW)	3.087	7.329	630
Hydraulic (< 50MW)	1.932	3.491	300
Biomass	562	2.936	765
Urbansolidwaste	224	703	174
Wind	21.520	42.373	3.644
Photovoltaic solar	4.281	7.343	631
Biogas	209	875	210
Thermoelectric solar	1.149	1.777	732
TOTAL ELECTRIC AREAS	**46.486**	**86.600**	**8.788**

Source: Energy in Spain 2011. State Secretariat for Energy.
Ministry of Industry, Energy and Tourism (MINETUR).IDEA data.

The figures in relation to the installed power of renewable technologies provide meaningful information on the importance of the same.The distribution per Autonomous Community illustrates the specific weight of each of the regions in relation to the amount of power installed.

[2]Provisional for 2011.

[3]Does not include pumping production.

Installed power using renewable technologies under the special regime perregion (MW)							
Province	**Photovoltaic solar**	**Thermoelectric solar**	**Wind**	**Hydraulic**	**Biomass**	**Other**	**Total**
ANDALUCIA	790	598	3.037	143	228		4.975
ARAGÓN	142		1.723	255	34		2.155
ASTURIAS	1		386	77	86		550
ISLAS BALEARES	63		4				67
ISLAS CANARIAS	138		145	0	1		284
CANTABRIA	2		35	74	3		114
CASTILLA-LA MANCHA	879	100	3.709	128	58		4.874
CASTILLA Y LÉON	453		4.809	246	25		5.533
CATALUÑA	229		1.020	278	53		1.581
CEUTA Y MELILLA	0						0
VALENCIA	302		1.083	31	18		1.433
EXTREMADURA	530	300		20	17		867
GALICIA	12		3.291	493	77		3.873
LA RIOJA	85		448	27	5		565
MADRID	48			44	43		134
MURCIA	401	1	191	14	9		617
NAVARRA	148		984	151	46		1.329
PAÍS VASCO	22		194	53	58	0,30	327
Total	4.244	999	21.059	2.034	761	0,30	29.097

Source: APPA (NationalEnergyCommission)
(Data registeredend of 2011)

In terms of installed power, the total capacity of renewable energies under the special regime (as of 31 December 2011) totaled 29,097 MW, wind energy leading the way with 21,059 MW, followed by photovoltaic solar energy (4,244 MW), mini-hydraulic energy (2,034 MW), thermoelectric solar energy (999 MW) and biomass (761 MW).

Generation of energy using renewable technologies under the special regime per region (GWh)							
Province	**Photovoltaic solar**	**Thermoelectric solar**	**Wind**	**Hydraulic**	**Biomass**	**Other**	**Total**
ANDALUCIA	1.401	836	6.218	291	1.313	-	10.059
ARAGÓN	268	-	3.865	718	138	-	4.990
ASTURIAS	1	-	609	192	515	-	1.317
ISLAS BALEARES	101	-	6			-	107
ISLAS CANARIAS	230	-	353	2	9	-	593
CANTABRIA	2	-	63	213	14	-	292
CASTILLA-LA MANCHA	1.659	195	6.745	441	270	-	9.310
CASTILLA Y LEON	757	-	8.708	611	155	-	10.231
CATALUÑA	356	-	1.886	917	224	-	3.384
CEUTA Y MELILLA	0	-	-	-	-	-	0
VALENCIA	442	-	1.820	22	47	-	2.331
EXTREMADURA	1.011	748		33	99	-	1.890
GALICIA	15	-	7.398	1.145	276	-	8.835
LA RIOJA	136	-	937	77	11	-	1.161
MADRID	60	-		108	164	-	331
MURCIA	656	0	304	56	36	-	1.052
NAVARRA	288	-	2.463	334	276	-	3.361
PAÍS VASCO	25		439	116	167	0,13	747
Total	**7.407**	**1.779**	**41.814**	**5.275**	**3.715**	**0,13**	**59.990**

Source: APPA (NationalEnergyCommission)
(Data registeredend of 2011)

Production of electricity using renewable sources under the special regime amounted to 59,990 GWh, which accounts for 22.2% of the total demand for electricity for the year 2011[4].Of the renewable energies classified under the special regime, wind energy continues to contribute most to demand, at 16%, followed by solar technologies (photovoltaic and thermoelectric) with 4%, and biomass with 1.4%.

In relation to the regions, Castilla y Leon, Castilla-La Mancha, Andalucia and Galicia are the geographic regions in which total installed power using renewable energies is the greatest.

Contribution to GDP

There was a reduction in the direct contribution of the sector to GDP in 2011.This was the first time the share of the renewable energy sector has dropped since this information began to be analysed. This was caused by a fall in the production of wind energy, generating a drop of 11.4% in the share of this technology, in addition to the coming into force of retroactive cuts in photovoltaic solar technology defined under Royal-Decree Law 14-2010[5] and which effectively limited the annual hourswith the right to subsidy of these facilities.As of the close of 2011, the renewable energy sector provided the domestic economy with the amount of 10.244 million euros.In terms of GDP, the sector accounted for 0.95%.

Thermoelectric solar energy or incipient technologies such as ocean and mini-wind energy are those which registered the greatest rate of growth in the year 2011, offsetting the drop in other technologies such as thermosolar, biofuels, wind and photovoltaic energy.Among the renewable technologies under the special regime, the biggest contribution was that of photovoltaic solar energy (24.9% of the total), followed by wind energy (25.6%), and thermoelectric solar energy (23%).

The renewable energy sector not only contributes to reducing energy dependency on imports, but is also an effective manner of offsetting Spain´s balance of trade.In 2011, exports increased three times more than imports, thereby creating a net export balance.The country exported goods and services worth 3.362 million euros, and imported 2.362 million euros.

In relation to the 2011 fiscal balance, the renewable energy sector represented a positive balance of over 687 million euros to the public coffers.Subsidies received dropped by around 40%.

Contribution to R&D&I

There are figures available in relation to the contribution to R&D&I for 2011, the most recent being from 2010. Investment in that year amounted to 302.8 millioneuros, approximately 4.5% of the total share of GDP of the renewable energy sector.This

[4] Source: Renewable energy generation under the special regime, the National Commission for Energy, Demand for Electricity. Spanish Electrical Network.

[5] Under which urgent measures were established to correct the tariff deficit in the electric sector.

percentage is far higher than the national average, which accounted for 1.38% of GDP this year.This considerable difference is due to the fact this a sector which is constantly evolving in terms of technology, and some, such as ocean and geothermal technologies, are largely geared to activities involving R&D&I.

Spanish technological potential in relation to renewable energy is significant. The development of these energies has resulted in considerable progress in terms of technological research, development which has not yet reached its limits (for example, in relation to new materials in connection with thermosolar energy).

In comparison with the EU, Spain sees greater efforts in the scope of wind and thermal solar energy, underlined by the fact the country is market leader in these areas.

Environmental impact

Certain facts in relation to the environmental impact caused by renewable energies:

- In 2011, renewable energies under the special regime replaced 59,948 GWh of electricity produced using fossil fuels.
- The generation of electricity using renewable energy has helped reduce the generation of greenhouse gases, preventing the emission of the equivalent of 33.4 million tons of CO_2 in 2011.
- The equivalent of 179 million tons of CO_2 was prevented from entering the atmosphere during the period 2005-2011.
- Calculation of the emission of other contaminant gases:45,335 tons of sulphur dioxide (SO_2); and 27,616 tons of nitrogen oxide (NO_x) were prevented from entering the atmosphere in 2011.
- The generation of electricity using renewable energies saved the country from importing the equivalent of around 11.7 million tons of oil (toe) in 2011, representing savings of approximately 2,100.6 million euros.

Environmental impact is one of the attributes of renewable energies.Concern for the environment has led to the implementation of European policies in our national legislation.These policies are geared to the reduction of environmental waste, specifically CO_2. However, the environmental variant does not seem to pull much weight at the time of investing in renewable energy.Or at least, it is not the main reason companies choose to do so.

Foreign trade

During the period between January and November 2008, Spain exported products associated with the generation of renewable energy (components and equipment) to the amount of 838.1 million euros[6].Wind energy accounted for the biggest percentage (38%), followed by the export of solar energy (25%).

In all the UE, Spain ranks the third place in exporting of goods to generate wind energy, behind Denmark and Germany.

At the present, certain companies dedicated to the manufacture of materials and machinery for the production and transformation of electrical energy are looking to the foreign market due to the lack of internal investment in renewable energy.

This is one of the complaints put forward by both producers of goods and equipment related to renewable energy and large-scale energy producers: this lack of investment in Spain is compromising development and forcing producers to target emerging markets (Latin America, North Africa, certain Asian countries) which are undergoing a boom in this type of energy, and where Spanish producers have encountered success.

1.2.The influence of external factors in the sector

The EU has invested heavily in renewable energy as a solution not only for the emission of large amounts of greenhouse gases, but also as a means of reducing the energy dependency of the Old Continent.

According to the experts interviewed, this has been a major factor in companies from the traditional energy sector turning to the renewable energy sector.

Europe depends largely on imports to meet its energy needs, a dependency of around 85% in the case of Spain.As a means of overcoming this problem considerable investment needs to made in energy efficiency and the generation of energy using indigenous sources such as clean energies.

On 25 July 2009, Directive 2009/28/CE came into force ruling on the promotion of the use of energy from renewable sources and defining a binding target for Spain of a 20% share of energy from renewable sourcesin overall energy consumption by the year 2020, with a 10% share in transport consumption.This Directive defines criteria of sustainability for biofuels and bioliquids in relation to the reduction in the emission of greenhouse

[6]General Secretariat for Analysis, Strategy and Evaluation, with data from the Customs Department.State Secretariat for Trade.

gases, and the protection of land which is valuable in terms of biodiversity and/or land containing large reserves of coal.

In accordance with the Directive, each Member State is obliged to draw up a National Renewable Energy Action Plan (PANER, in Spanish), 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 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.

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) establishing growth objectives for all renewable energies, particularly those from wind, solar and biomass sources.

Directive 2010/31/UE on energy efficiency in buildings regards the introduction of renewable sources in buildings as necessary in order to reduce energy dependency and emissions of greenhouse gases.

The development of renewable energies backed by domestic and European objectives has resulted in a major replacement of conventional technology.For purposes of comparison, if the renewable energies under the special regime did not exist, conventional power plants would operate for around 1,500 additional hours per year.

The role of public subsidies for "green energy" has been a decisive factor for the same having taken off in Spain.And 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 (Latin America and North Africa).

Public subsidies for renewable energies were responsible for the boom the sector enjoyed 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.And this affects all the "links" in the chain:producers, manufacturers of equipment, installers, etc.

1.3.The economic-corporate scenario

The renewable energy sector in Spain is still relatively new, with an average age of 16 years, and where almost one in three companies was founded in the last ten years.The renewable energies registering the biggest growth 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.

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.

It is hard to quantify the number of companies in the sector due to the fact many different types of company are registered under the name of "renewable energies" in accordance with the activities performed in the sector:production, distribution, etc. According to CNAE-09, companies may be placed into sub-groups:

3512. The transportation of electrical energy.
3513. The distribution of electrical energy.
3514. The marketing of electrical energy.
3518. The production of wind-powered electrical energy.
3519[7]. The production of other types of electrical energy.

According to data from September 2009, there were 1,082 companies registered in Spain under these headings:16.45% were involved with transport; 32.99% with distribution; and 1.94% with sales.

48.62% were dedicated to the p*roduction of wind-powered electrical energy* (14.05%) and to the p*roduction of other types of electrical energy* (34.57%).The presence of renewable energies in the corporate fabric of this activity is considerable.

[7]Includes the remaining renewable energy systems.

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.

Cities which are home to companies involved with other renewable energies include Madrid, Sevilla, Valencia, Barcelona, Valladolid, Jaen, Badajoz and Zaragoza.

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

In 2011, the renewable energy sector employed 118,657 workers, 54,193 direct jobs in the sector and 64,464 indirect jobs in other sectors of the Spanish economy.

1,678 direct jobs have been lost (-3%).The greatest loss of employment occurred in the wind energy sector, where 2,085 people have lost their jobs, above all in the industrial sector.The biofuels sector has also suffered significant cuts, where direct jobs have fallen by around 26%.

This drop in employment has been offset by the large increase in jobs associated with thermoelectric solar technology, due to the construction of new power plants, creating more indirect than direct jobs.

This positive trend is down to the biomass energy sector, with 769 new direct jobs, and the thermoelectric solar energy sector (624 direct jobs).In global terms, the greatest rise in employment occurred in the thermoelectric solar sector (9,711 new jobs), largely due to the construction of new power plants.The biomass sector also underwent considerable growth, generating 1,360 new jobs in 2011. The biggest loss of jobs (3,628) was registered in the wind energy sector, although the biggest percentage drop was registered in the biofuels sector, which suffered a drop of 26.6% (1,375 less jobs).

The following table illustrates the share of direct and indirect jobs in each of the renewable sectors for the year 2010.

Employment (2010)				
Sector	**Direct job**	**Indirect job**	**Total jobs**	**%**
Wind	30.651	24.521	55.172	37,2%
Photovoltaic solar	19.552	8.798	28.350	19,1%
Thermoelectric solar	9.346	5.608	14.954	10,1%
Electric biomass	7.172	6.789	13.961	9,4%
Thermal use biomass	5.754	5.640	11.394	7,7%
Thermal solar	6.757	3.041	9.798	6,6%
Common activities	4.262	2.718	6.980	4,7%
Incineration of waste	1.415	637	2.052	1,4%
Biofuels	964	988	1.952	1,3%
Hydraulic and mini-hydraulic	1.078	485	1.563	1,1%
Electric biogas	664	681	1.345	0,9%
Geothermal	415	162	577	0,4%
Ocean energy	74	38	112	0,1%
Thermal use biogas	55	56	111	0,1%
Solid urban + industrial waste	50	23	73	0,05%
TOTAL	**88.209**	**60.185**	**148.394**	**100%**

Source:Department of Renewable Energies (30/09/2011).
General Secretariat of the Department of Planning and Research.
Institute for the Diversification and Saving of Energy (IDAE)

The information regarding the direct job by activity is shown in the next table.

Share by activity	
Sector	**Direct job %**
Manufacture of equipment	37,6%
Development of projects and services	18,3%
Construction and installation	16,9%
Operation and maintenance	12,0%
Marketing, sale of equipment	10,3%
R&D&I	4,5%
TOTAL	**100%**

Source:Department of Renewable Energies (30/09/2011).
General Secretariat of the Department of Planning and Research.
Institute for the Diversification and Saving of Energy (IDAE)

2.1.Workers in the sector: social and labour profile

When addressing the renewable energy employment market, it is hard to define the occupations in the sector, as the information available at the Public State Employment Service (SPEE), the government entity entrusted with the bureaucratic management of the contracts entered into, only provides the breakdown of the Primary Occupation Group (CNAE 35), making it impossible to determine both the number of contracts and the specific occupations of the renewable energy sector, classified in primary groups which include occupations common to several different activities.

The 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).

In recent years the number of machine tool operators, chemical product operators, electrical production plant operators, administrative personnel, transport personnel, top-level professionals in business organization, technical and senior engineers, and pipe fitters hired has increased.

The number of maintenance mechanics, manufacturing industry workers, electricians, welders, electrical technicians, and warehouse personnel hired has dropped.

Using the affiliation of workers to the General Social Security Scheme[8] as a variable, the characteristics common to workers from this sector are as follows (data from 2009):

- A predomination of men.The percentage of women in the *electrical energy business* (CNAE 3514) is greater than in other activities.

- The highest average age is that of workers involved in the *transportation, distribution and marketing of electrical energy,* whilst in the activity of the *production of wind and other types of energy* (CNAE 3518 and CNAE 3519) the proportion of people of between 25-35 years of age is greater.

- The percentage of permanent contracts is greater in the activity of the *transportation, distribution and marketing of electricalenergy* than in the *production of wind and other types of energy,* the latter registering a greater temporary nature with regard to the employment relations of its members.

- 95.58% of the workers in activity have been hired on a permanent basis.

- With regard to the nationality of the workers, only 1.12% are foreigners, and these are more evident in the activity of the *production of renewable energy other than wind* (CNAE 3519). In turn, slightly more than half of these foreign workers are from countries outside the EU, except in the wind energy sub-sector, where more workers are from the EU.

- 2.42% of all the workers registered in the sector belong to the Special Autonomous Workers Regime.

[8]Social Security in Spain is the State´s main system of social protection. The purpose of the same is to guarantee specific and individual services. It encompasses a contributory mode of a professional scope with funding based on member contributions, and a non-contributory mode of a universal scope with funding based on the State Budget.

- The highest proportion of autonomous workers is found in the activity of the *production of other types of electrical energy* (19.92%), whilst the *production of wind-generated electrical energy*accounts for2.19% only.

2.2.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.

Renewable energies produce five times more jobs than the generation of traditional energy.According to data supplied by Institute for the Diversification and Saving of Energy (IDAE), there are approximately 750 companies in the sector.Over 52% of these companies have less than 25 employees, and only 3.8% have over 500. These low figures are partly explained by the decentralisation and dispersion of the exploitation projects, which are located in regions where the resource exists.

In relation to technology, the highest number of companies are involved in wind energy, followed by solar thermal and geothermal energy.

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, new jobs will be created mainly in productive regions in rural areas where there were few industrial opportunities until now.

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 (above all in relation to solar activity).Many companies found it hard to maintain their workforces and to create jobs, particularly those of a smaller size.

Perspectives for the creation of jobs are focused on the areas involved with the installation and maintenance of new plants, for which new skilled technicians and workers are required.The areas in which it is hoped jobs will be created are:logistics, the management of facilities and R&D&I.All the 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.

The hiring of manpower varies in accordance with the type of company:small and medium enterprises often resort to the Public State Employment Service, whereas large enterprises tend to select their own personnel.

2.3.Training needs in the sector

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 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, a family to which the renewable energy sector belongs.There are no middle-cycle courses for this professional family.

Official Vocational TrainingProfessional Family of Energy and Water	
	Position
Upper cycle	Senior Power Plant Technician
	Senior Energy Efficiency and Thermal Solar Energy Technician
	Senior Renewable Energies Technician

Source:Ministry of Education, Culture and Sport.

Among the courses related to the renewable energy sector are those teaching the professional family of installation and maintenance.The table below illustrates the official middle-level and upper-level positions of this professional family.

Official Vocational TrainingProfessional Family of Installation and Maintenance	
	Position
Middle cycle	Heat Producing Installation Technician
	Cold Storage and HVAC Installation Technician
	Electro-mechanical Maintenance Technician
Upper cycle	Senior Project Development and Thermal and Fluids Installation Technician
	Senior Thermal and Fluids Installation Maintenance Technician
	Senior Industrial Mecatronics Technician

Source:Ministry of Education, Culture and Sport.

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.

3. Recognition of qualifications:experience in the sector

The recognition of the 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.

The knowledge, skills and competences which make up the qualifications may be obtained via several routes:formal, non-formal and informal.Official training, non-official training (including vocational training for employment) and work experience (among others) are the main equivalences of these routes.

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".

The formal route, consisting of formal training and education, does not require the aforementioned procedure, as the obtainment of any official diploma involves the implicit

recognition of the qualification in question.It is the non-formal and informal routes which require express recognition.

A procedure exists in Spain for the recognition of professional skills acquired through work experience. This recognition is defined under Royal Decree 1224/2009, dated 17 July, which sets forth the guidelines to be developed in specific regulations at a later date and which transfers these guidelines to the effective recognition of the different qualifications.

3.1. The system for the recognition of skills

Royal Decree 1224/2009, dated 17 July, ruling on the recognition of professional skills acquired through work experience determines the sole procedure, both in the scope of education and employment, for the assessment and accreditation of professional skills acquired 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 partialcumulative 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.

3.2. Some examples of the certification of skills

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 unitsin 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.

4. 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.

In Spain, talking about the installed power, wind energy is the most important, followed by photovoltaic solar energy. In relation to the regions, Castilla y Leon, Castilla-La Mancha, Andalucía and Galicia are the geographic regions in which total installed power in renewable energies is higher.

The promotion in the use of renewable energies represents benefits for the country: 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.

The renewable sector in Spain is new, with an average age of 16 years, and where almost one in three companies was founded in the last years. The renewable energies registering the biggest growth are photovoltaic solar, thermal solar and wind energy.

There are two 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.

The companies are involved in many activities: installation, maintenance, market equipment, energy production, etc. The sector is highly stable in terms of labour, although the current economic crisis is also affecting this stability.

The profile of the companies in the renewable sector is of the SME company, with less than 25 employees in half of them. The greatest number of companies belongs to wind energy, followed by thermal solar energy.

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 come 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. The lack of investment in the sector may produce a fall in the jobs bigger than it is foreseen.

There are not big needs of training among the sector workers. The current training offer in Spain covers the training needs widely, both in formal training (at professional and university training) and vocational and educational training. Large enterprises have their own training plans to face the training needs which may arise among their workers unusually.

A procedure exists in Spain for the recognition of professional skills acquired through work experience: Royal Decree 1224/2007, dated July 17th, which sets the main guidelines for the specific and concrete recognition of these competences and skills.

The procedure comprises three phases: candidate's guidance; assessment of professional skill; and accreditation and registration of that skill and competence. The regions are in charge of elaborating the calls of the procedures, in order to meet the objectives of validity, reliability, objectivity and technical rigour of the assessment.

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Skills files: occupations described in terms of learning results

PROFILE	
ECONOMIC ACTIVITY (CNAE)	NACE 08-D
OCCUPATION	Photovoltaic solar installation operator
EQF level	EQF-4
ISCED level	3
Learning results A	Knowledge KA1. To be familiar with the principles of the assembly of photovoltaic solar facilities. KA2. To define the elements involved in commissioning photovoltaic solar installations. KA3. To be familiar with the principles of safety required for the assembly of photovoltaic solar installations.
	Skills SA1. To perform the basic operations involved in the assembly of photovoltaic solar installations. SA2. To be familiar with the principles of safety set forth in the regulations in force in relation to the assembly of photovoltaic solar installations.
	Competences CA1. The assembly of photovoltaic solar installations. CA2. The redesign of photovoltaic solar installations.
Learning results B	Knowledge KB1. A description of the principles of the assembly of photovoltaic solar installations. KB2. To possess knowledge of the regulations in force in relation to the maintenance of photovoltaic solar installations.
	Skills SB1. To organise the elements needed to perform the basic operations involving the assembly of photovoltaic solar installations. SB2. To perform the activities needed for the assembly of photovoltaic solar installations, in accordance with the safety principles required.
	Competences CB1. The maintenance of photovoltaic solar installations.

PROFILE	(CON-31311090)
ECONOMIC ACTIVITY (CNAE)	NACE 08-D
OCCUPATION	Wind energy plant operator
EQF level	EQF-4
ISCED level	4
Learning results A	Knowledge KA1. Basic principles in relation to starting and stopping turbines. KA2. Operating tubines. KA3. Selecting the most suitable computer programs for the different tasks for starting, maintaining and operating turbines.
	Skills SA1. The execution of maintenance duties in relation to the primary elements of the plant control system. SA2. Reviewing and maintaining plant control systems in relation to the electrical energy generator process. SA.3. Performing the operations required for starting and stopping turbines.
	Competences CA1. The supervision and monitoring of the actual operation and maintenance conducted at the facility.
Learning results B	Knowledge KB1. Electricity, computer science, regulations in relation to renewable energy. KB2. Electricity, pneumatics and hydraulics.
	Skills SB1. Operations on the wind farm involving the connection and disconnection of the plant´s output lines with the electrical network. SB2. Laying a line on the ground in order to perform maintenance and repair work. SB3. The compilation of reports, including the most significant incidents and data on the facility.
	Competences CB1. Compiling reports and proposals on the replacement of installations or equipment.

PROFILE	(CON-11)7294
ECONOMIC ACTIVITY (CNAE)	NACE 08-D
OCCUPATION	Assembler-installer of solar energy panels
EQF level	EQF-4
ISCED level	4
Learning results A	Knowledge KA1. Knowing how to assemble thermal solar installations. KA2. Knowing the elements involved in the commissioning of thermal solar installations. KA3. Knowledge of the maintenance of thermal solar installations. KA.4. Defining the safety principles required in accordance with the legislation in force.
	Skills SA1. The assembly of thermal solar installations. SA2. Conducting operations involving the commissioning and maintenance of thermal solar installations. SA3. The assembly of solar panels.
	Competences CA1. Redesigning thermal solar installations. CA2. Assembling mounting frames and panels. CA3. Commissioning and operating thermal solar installations. CA4. Skills in welding techniques. CA5. Assembling conventional power generating equipment and support systems. CA6. Personal attributes:manual skills, physical resistance, learning capacity, organisational capacity, creativity.
Learning results B	Knowledge KB1. Knowing how to install solar panels. KB2. Knowledge of the elements involved in the supervision of the assembly of solar panels. KB3. Knowledge of the maintenance principles of thermal solar panels.
	Skills SB1. Dealing with the assembly of electrical and hydraulic sensors and circuits of thermal solar installations. SB2. Controlling the installation of solar panels in accordance with quality criteria.

	Competences CB1. Assembling electrical and hydraulic sensors and circuits of thermal solar installations. CB2. Assembling electronic circuits and equipment of thermal solar installations. CB3. Preparing and organising the work involving the assembly of mounting frames, panels, storage systems, support systems, monitoring systems, electric and electronic circuits and equipment.

PROFILE	(CON-11) 8202
ECONOMIC ACTIVITY (CNAE)	NACE 08-D
OCCUPATION	Assembler of electric and electronic equipment
EQF level	EQF-2
ISCED level	3
Learning results A	Knowledge KA1. Basic knowledge of the assembly of renewable energy installations. KA2. Having a basic knowledge of how small-scale thermal solar, photovoltaic and wind energy installations operate. KA3. Knowing the basics in relation to safety in the assembly of renewable energy installations.
	Skills SA1. Performing operations involving the assembly of renewable energy installations in accordance with the instructions of a supervisor.
	Competences CA1. Performing basic operations in relation to the assembly of thermal solar installations. CA2. Performing basic operations in relation to the assembly of small-scale wind energy installations. CA3. Performing basic operations in relation to the assembly of photovoltaic solar installations. CA4. Performing basic mechanised operations.
Learning results B	Knowledge KB1. Basic knowledge of the maintenance of renewable energy installations. KB2. Knowing the principles of basic safety in relation to maintenance. KB3. Knowing the basic principles in relation to the environment.
	Skills SB1. Performing basic operations in relation to the maintenance of renewable energy installations under the orders of a supervisor.
	Competences CB1. Performing basic operations in relation to the maintenance of thermal solar installations. CB2. Performing basic operations in relation to the maintenance of small-scale wind energy installations. CB3. Performing basic operations in relation to the maintenance of photovoltaic solar installations.

PROFILE	
ECONOMIC ACTIVITY (CNAE)	NACE 08-D
OCCUPATION	Photovoltaic solar plant operator
EQF level	EQF-4
ISCED level	3-4
Learning results A	Knowledge KA1. Assembling photovoltaic solar installations. KA2. The commissioning of photovoltaic solar installations.
	Skills SA1. Assembling mounting frames, panels, storage systems, support and monitoring systems, electric and electronic circuits and equipment in photovoltaic solar installations. SA2. Performing preventive, corrective and emergency tasks. SA3. Assembling storage/accumulation systems in photovoltaic solar installations.
	Competences CA1. Handling of computer tools. CA2. Handling of GPS. CA3. Manual skills. CA4. Physical resistance.
Learning results B	Knowledge KB1. Operating photovoltaic solar installations. KB2. Maintenance of photovoltaic solar installations.
	Skills SB1. The commissioning and verification of the working order of photovoltaic solar installations. SB2. Activating and monitoring the installations of a hydroelectric plant. SB3. Controlling and operating auxiliary systems located outside the plant, understanding the layouts of the different circuits.
	Competences CB1. Handling of topographical equipment. CB2. Handling solar installation components (solar panels, mounting frames, reversals, measuring equipment, monitoring equipment). CB3. Concentration, dynamism.

APPENDICES

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 (CO_2), methane (CH_4), nitrogen oxides (NO_x), and chlorofluorocarbons (CFCs). CO_2 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; CH_4 is 25 times more harmful and registers a share of 13%; and the effect of NO_x, responsible for around 6%, is 230 times greater than that of CO_2.

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.

Legislation

The norm governing the overall framework

Royal Decree 661/2007, dated 25 May, governing the activity of the production of electrical energy under the special regime.

Economic regime for new photovoltaic facilities

Royal Decree 1578/2008, dated 26 September, ruling on remuneration in relation to the activity of the production of electrical energy using photovoltaic solar technology for facilities opened after the deadline for the maintenance of remuneration of Royal Decree 661/2007, dated 25 May, for the said technology.

Provisions ruling on other aspects of the special regime and partially amending that set forth in Royal Decrees 661/2007 and 1578/2008

Royal Decree-Law 6/2009, dated 30 April, defining certain measures in the energy sector and approving the "social tariff".

Cabinet agreement dated 13 November 2009, determining the planning of the projects or facilities submitted to the administrative records for the pre-allocation of remuneration for electrical energy production facilities set forth in Royal Decree-Law 6/2009, dated 30 April.

Royal Decree 1565/2010, dated 19 November, defining and amending certain aspects in relation to the activity of the production of electrical energy under the special regime.

The correction of errors contained in Royal Decree 1565/2010, dated 19 November.

Royal Decree 1614/2010, dated 7 December, defining and amending certain aspects in relation to the activity of the production of electrical energy using thermoelectric solar and wind technology.

Royal Decree-Law 14/2010, dated 23 December, defining urgent measures for the correction of the tariff deficit in the electrical energy sector.

Royal Decree 1699/2011, dated 18 November, defining the connection to the small-scale electrical energy production facilities network.

The correction of errors contained in Royal Decree 1699/2011, dated 18 November, defining the connection to the small-scale electrical energy production facilities network.

Royal Decree-Law 1/2012, dated 27 January, defining the suspension of the procedures involving the pre-allocation of remuneration and the end of economic incentives for new electrical power plants using cogeneration, sources of renewable energy and waste.

Other norms

Royal Decree 191/2010, dated 26 February, amending the Special Tax Regulations approved under Royal Decree 1165/1995, dated 7 July.

Royal Decree 1088/2010, dated 3 September, amending Royal Decree 61/2006, dated 31 January, concerning the technical specifications of petrol, diesel fuel, the use of biocarbonsand the sulphur content of fuels for maritime use.

Royal Decree 1738/2010, dated 23 December, defining mandatory biocarbons targets for the years 2011, 2012 and 2013.