RENEWED SKILLS

Lifelong Learning Programme

Recognition of competences in the renewable energy sector in the EU

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Research and Analysis on current socio-labour situation in the energy sector in the EU

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1. <u>THE RENEWABLE ENERGY SECTOR: SOCIOECONOMIC FACTS AND LABOUR DATA</u>

1. <u>1 Introducion</u>

Current situation
The disaster in Fukushima on 11 May 2011 animated the German government to decide on a fundamental restructuring of its energy sources on 6 June 2011: until the end of 2022 at the latest, Germany plans to progressively phase-out all use of electricity from nuclear reactors. The eight nuclear power plants which were decommissioned in the spring of 2011 will remain off the grid.

These agreements have substantiated and accelerated numerous measures which had already been adopted by the German government within the framework of the Energy Concept in September 2010.

As a whole, the share of renewable energy sources has steadily increased over the last ten years. The following pertains to Germany for 2012:[1]
National:

- The share of renewable energy steadily increased to 12.6% (2010: 11.2%) of total final energy consumption. This is the right path for achieving the goal set by the German government of an 18% share of renewable energy of total final energy consumption by 2020.
- 19.5 billion euros were invested in renewable energy sources (2010: 27.9 million euros). This can be attributed above all to the sharp drop in the price of photovoltaic systems.
- 377,800 people were employed in the renewable energy sector (2011: 381,600)
- The positive overall development last year can be attributed solely to developments in the electricity sector: the share of renewable energy increased to 22.9% (2010: 17.1%) of gross electricity consumption. In the hear sector, the share of renewable energy remained the same as the previous year despite an increase in gross energy consumption. Development in the market, however, was too limited to achieve growth in comparison the 10.4 % reached in the previous year. The most difficult development until now has been registered in the transport sector. This sector reached its interim peak in 2007. Since then, the share of biofuels for transport
- due to the collapse of the market for pure biodiesel and the slow introduction of E10 to the market, amongst other reasons - decreased again to 5.5%.

[1] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (Hrsg.)(2013): Renewable Energy Sources 2012.Data from the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) on trends in renewable energy in Germany in 2012. Based on information supplied by the Working Group on Renewable Energy-Statistics (AGEE-Stat), p.5.

International:
Compared internationally, the German renewable energy sector remains in the lead.

- installations and technology amounting to approx. 12 billion euros were exported in 2008
- the German share of the worldwide market for the wind energy branch amounts to over 25%
- Germany is the worldwide leader in the installed capacity of photovoltaic systems and comes in second with wind power installations

1.2 Segments on energy supply[2]

1.2.1 Wind energy

The expansion of installations for the use of wind energy also showed a significant upward trend in 2012. New turbines with a capacity of 2,440 MW were constructed which accounted for a significant increase in comparison to the previous year (2,007 MW). 541 MW were accounted for within the framework of repowering measures.
By the end of the year, the total installed wind capacity in Germany amounted to nearly 31,315, 280 MW of which was installed offshore.
However the around 46 billion kWh of electricity generated was less than the previous year (48.9 billion kWh) which can be attributed to the considerably less favourable wind conditions compared to 2012. Yet with a share of 7.4 % of gross electricity consumption (2011: 8.1 %), wind energy clearly maintained its position as the most important source of electricity amongst the renewable energy sources. The share of offshore wind energy again remained low in 2012 and accounted for 1.5 % of total wind power generation. Nonetheless, the 675 million kWh generated offshore showed an increase of approximately 19 % compared to the previous year.

1.2.2 Solar energy

Despite cuts in funding, various cases of insolvency and factory closures, projects which had already been scheduled or initiated were implemented which lead to a new record high in construction amounting to 7.6 GW. The strongest growth was registered in **photovoltaics** which made up 4.5 % of gross electricity consumption.

Investments amounted to 11.2 billion euros in 2012 which displayed a decrease of nearly 26% in comparison to the previous year. This drop can be attributed to a renewed significant decrease in system prices.

A series of capacity adjustments were made by the majority of module manufacturers in 2012 due to poor business results: 17 companies or divisions of companies along the module value chain exited the market. Only seven of those

[2] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (Hrsg.)(2013): Renewable Energy Sources 2012, p.5

who exited the market did so as a result of the insolvency of a total of five companies.[3]

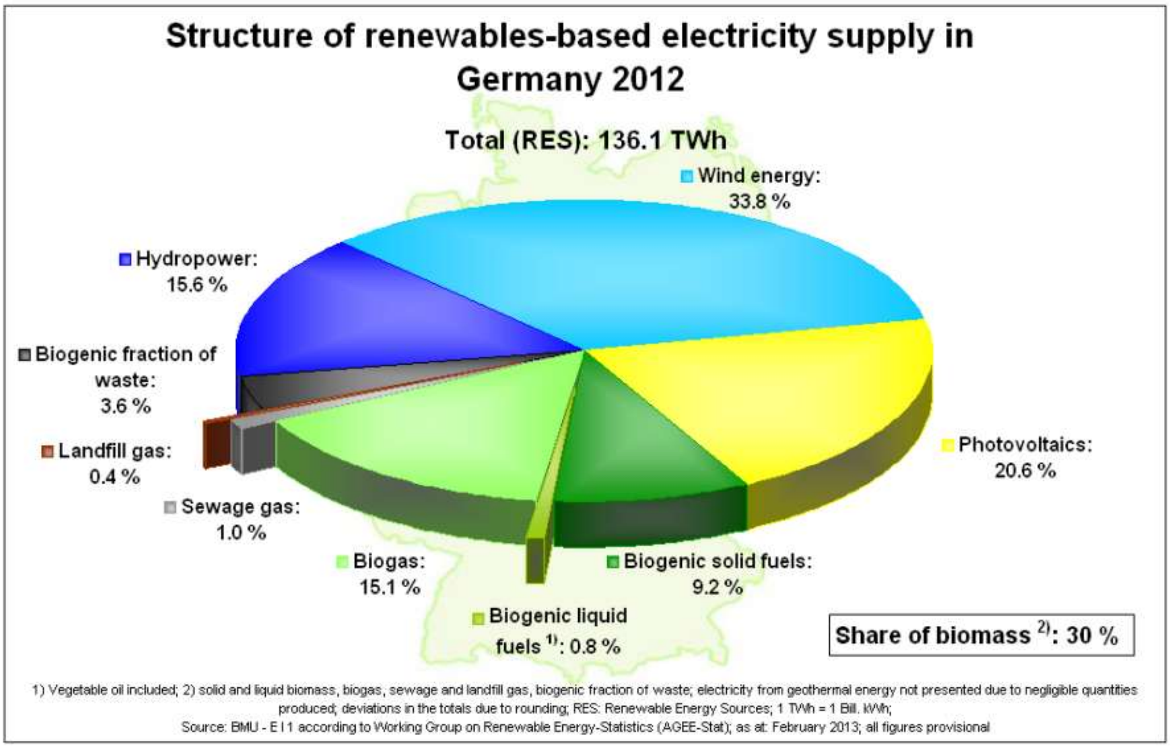
1.2.3 Hydro energy

For hydropower in 2012, there was a weather-induced increase in electricity generation and the expansion of electricity generation capacities remained low as in previous years. With 21.2 billion kWh, hydropower supplied 3.6 % of gross electricity consumption.

1.2.4 Biomass

The upward trend also continued in the production of electricity from biomass due to expansion in the use of biogas, yet it significantly decreased in momentum compared to the previous year. The production of electricity from **biomass** increased to 6.6 % in 2012.

The importance of electricity generated using **geothermal energy** remained low even though two additional heating plants began regular operation and approximately 35 % more electricity was generated than in the previous year with a good 25 million kWh.



Source:[4]

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[3] The remaining 10 divisions of companies or subsidiaries were shut down by their parent companies. As a result, many of the filed insolvency situations did not lead to the shutting down of the concerned sites or companies. Some were bought out by new investors who now continue to operate substantial parts of the company. The most prominent example in the German market is the company Hanwha which acquired Q-Cells (see Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2013):Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2012-eine erste Abschätzung, Berlin, p. 10)

[4] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (Hrsg.)(2013): Renewable Energy Sources 2012.Data from the Federal Ministry for the Environment, Nature Conservation and

1.3 The Influence of external factors on the sector

National factors
1.Legislation

With the cabinet decisions of 6 June 2011 on the transformation of the energy system, the German government concluded the following transposition targets which are extensive for the renewable energies sector:[5]

1. Phasing-out of use of nuclear energy by not later than the end of 2022 and an increase in the share of renewable energy in electricity generation amounting to 35%. (based on the Renewable Energy Sources Act (EEG), amended 1.1.12);

2. Dynamic expansion of renewable energy sources in all sectors,

3. Rapid expansion and modernisation of electricity grids (based on the revised Energy Industry Act).
Furthermore, the "Act concerning measures to speed up the expansion of power grids" (NABEG) entered into force in July 2011 to ensure the accelerated construction of new transmission lines.

4. Improvements in energy efficiency with the aid of modern technologies, especially in the building sector, in mobility and in electricity consumption.

Renewable Energy Sources in Germany
- key information 2012 at a glance -

Source: BMU - E I 1 based on Working Group on Renewable Energy-Statistics (AGEE-Stat) as at February 2013

Renewable energy sources: goals of the German government

RE share in electricity		RE share in gross final energy consumption	
At the latest	[%]		[%]
2020	at least 35	2020	18
2030	at least 50	2030	30
2040	at least 65	2040	45
2050	at least 80	2050	60

By 2020 the German government aims to raise the renewables' share in total heat supply to 14 percent, and to 10 percent in final energy consumption in the transport sector.
These targets will also help to lower greenhouse gas emissions in Germany by 40 percent by 2020 and by 80 to 95 percent by 2050 (compared to 1990). To this end, the government aims to reduce electricity consumption by 10 percent by 2020 and by 25 percent by 2050, while primary energy consumption is to fall by 20 percent by 2020 and 50 percent by 2050.

Source:[6]

Nuclear Safety (BMU) on trends in renewable energy in Germany in 2012. Based on information supplied by the Working Group on Renewable Energy-Statistics (AGEE-Stat).,p. 5

[5] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2012): Erneuerbare Energien in Zahlen. Nationale und internationale Entwicklung, Berlin, p. 8

[6] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2012): Erneuerbare Energien in Zahlen. Nationale und internationale Entwicklung, Berlin, p.11

EEG

The Renewable Energy Sources Act (Erneuerbare Energien-Gesetz, EEG) is a key component in the implementation of the EU Directive 2009/28/EC 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.

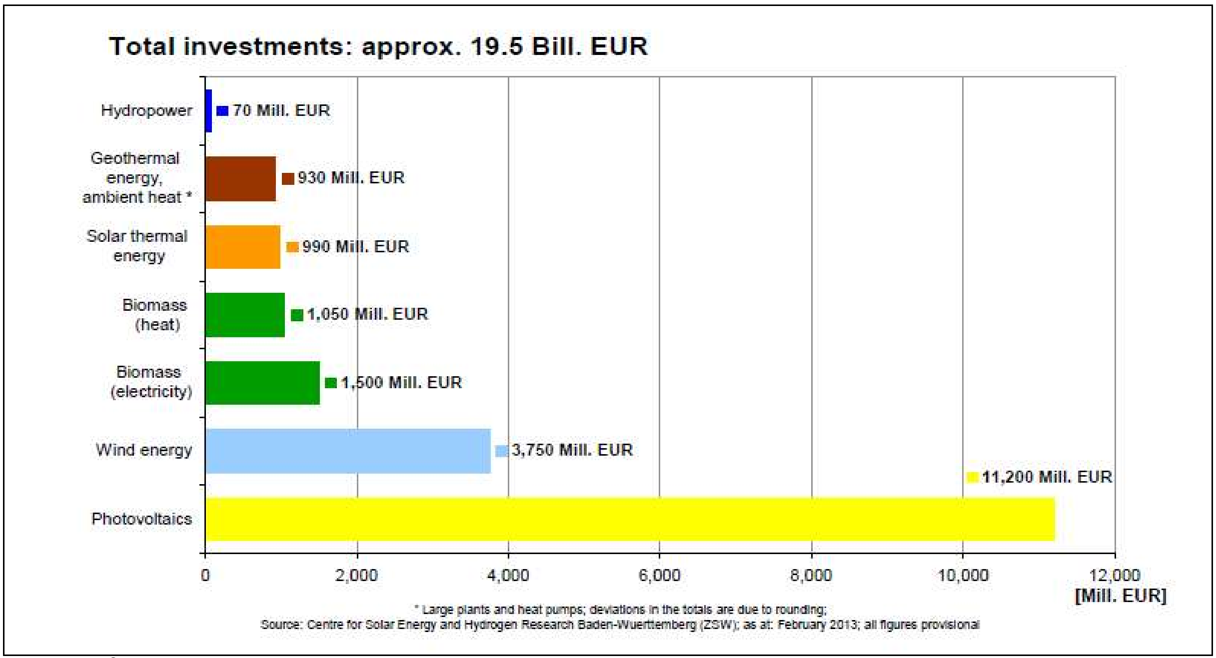
The act was most recently amended on 1 January 2012 and aims to increase the share of renewable energy to at least 80% of generated electricity until the year 2050.
The act regulates the grid connections of installations which generate electricity from renewable energies and determines which remuneration 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 distributed among electricity consumers.

2. Investments

In 2012, investments in installations reached a record high of 26.4 billion euros due to a boom in photovoltaics. Based on the drop in prices – as clearly intended with the EEG – investments declined over the past two years despite continued expansion in all sectors, yet they remained at a high level: a total of 19.5 billion euros were invested in 2012 (2011: 23.2 billion euros):
Photovoltaics still make up the largest portion due to continuous rapid expansion, yet the share of total investments has started to decline. [7] In the **wind energy** sector, an increase in investments of around 26% has been estimated.[8]

With continued expansion, the revenue resulting from **operating the installations** for the use of renewable energies is of growing economic importance. Revenue is drawing closer to the value of investments and amounted to 14.3 billion euros in 2012 which translates to an increase of around 5 % compared to the previous year (13.6 billion euros).

[7] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (Hrsg.)(2013): Renewable Energy Sources 2012" p. 11
Note: the data published here are provisional and are subject to change during the year. Differences between the values in the tables and the corresponding column or row sums result from rounding the figures.
[8] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2013):Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2012-eine erste Abschätzung, Berlin, p.4f



Source:[9]

International factors

1. EU- recommendations

The German Bundestag passed the "Renewable Energies European Law Adaptation Act" on 24 February 2011. With this law, the European Directive 2009/28/EC, the so-called Renewables Directive was implemented as a national law. The law includes amendments to the Renewable Energy Sources Act, to the Renewable Energies Heat Act, to the Energy Statistics Act, to the Federal Building Code, Building Construction Statistics Act and in the Biomass Sustainability Regulation. With a share of renewable energy amounting to 11.3% in 2010 of gross energy consumption, Germany already surpassed the national interim objective set in the EU Directive 2009/28/EC for the time period 2013/2014 (9.46 %).[10] This indicates that Germany in on the right path for achieving the national objective of 18% by the year 2020.[11]

2. Kyoto Protocol

The "first commitment period" of the Kyoto Protocol from 2008 to 2012:

Based on its current status, Germany will clearly exceed its Kyoto objective (21%): by the end of 2010, it was possible to already decrease the national greenhouse gas emissions by nearly 25% in comparison to 1990.

[9] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (Hrsg.)(2013): Renewable Energy Sources 2012" p. 11

[10] National reporting is carried out every two years.

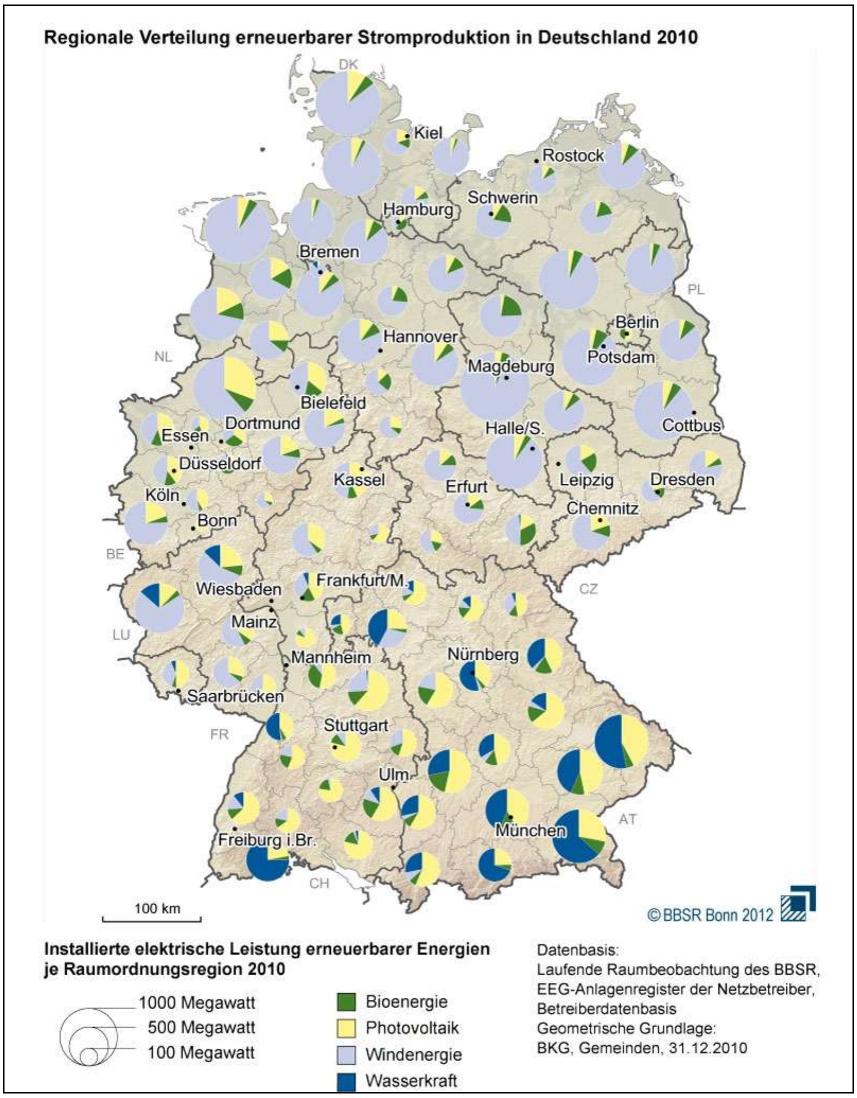
[11] Progress report under Article 22 of Directive 2009/28/EC on Promotion of the Use of Energy from Renewable Sources

1.4 Economic enterprising configuration

Regional location

The expansion of **wind energy use** is particularly advanced in Northern Germany. The majority of hydroelectric power installations can be found along the Isar, Inn, Main, Danube, Rhine and Moselle 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).[12]



Key:
Installed electrical capacity of renewable energies per spatial planning region 2010

Bioenergie = Bio energy
Photovolatik = Photovoltaics
Windenergie = Wind energy
Wasserkraft = Hydropower

[12] 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/Erneuerbare/EE__im__Raum.html (access:30.04.2013)

Ownership structure
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 E.ON, RWE, EnBW and Vattenfall (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.

The distribution in 2010 follows:[13]

Owners	Share of installed capacity
Individuals	39.7 %
Project engineers	14.4 %
Banks and funds	11.0 %
Farmers	10.8 %
Businesses	9.3 %
Power companies (E.ON, RWE, EnBW, Vattenfall)	6.5 %
Regional producers	1.6 %
Other	6.7 %

Companies
According to Hoppenstedt, around 200 German companies earn their money based on renewable energy with revenue amounting to more than 20 million euros. The main areas of activity are solar energy, wind energy, biofuels and hydropower. Amongst the top 50, 28 are public limited liability companies. A stock-index has been especially created for the renewable energy sector which displays the largest and most important companies in the world. The index is available on the internet. The German stock exchange has also introduced a corresponding index for German companies entitled "Prime IG Renewable Energies Performance-Index". With an increase of almost five-fold over the last three years, the index has clearly outperformed the DAX.

The first ten companies on the Hoppenstedt list follow:

Vestas Deutschland GmbH (wind energy)
Conergy AG (solar energy/wind power)
Enercon GmbH (wind energy)
Winergy AG (wind energy)
SolarWorld AG (solar energy)
E.ON Wasserkraft GmbH (hydropower)
REpower Systems AG (wind energy)
Nordex AG (wind energy)
Q-Cells AG (solar energy)
Verbio AG (biodiesel

[13] See Trend research(Hrsg.) (2010): Marktakteure Erneuerbare–Energien-Anlagen in der Stromerzeugung, Bremen

2. SOCIO-LABOUR SITUATION IN THE RENEWABLE ENERGY SECTOR

2.1 Workers in the sector: social and institutional profile

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.

The high proportion of skilled employees ist the prominent feature of companies in the renewable energy sector

	Without vocational	With qualifications	With a university degree
Photovoltaics	5.8 %	81.7 %	34.7 %
Hydropower	1.7 %	93.8 %	57.0 %
Wind	0.9 %	79.7 %	27.1 %
Solar thermal	9.5 %	80.3 %	24.4 %
Solar thermal power plants	6.7 %	84.8 %	44.1 %
Deep geothermal	2.1 %	85.6 %	50.4 %
Near-surface geothermal	6.6 %	81.1 %	15.3 %
Biogas	2.5 %	82.5 %	33.1 %
Liquid biomass	0.0 %	92.2 %	57.3 %
Solid biomass	3.1 %	86.5 %	29.7 %
RE overall	**4.1 %**	**82.1 %**	**32.1 %**
Manufacturing jobs	22.7 %	63.2 %	0.6 %
Technical jobs	4.0 %	88.3 %	37.7 %
Total	**15.0 %**	**69.5 %**	**9.9 %**

73% (269,400 people) were employed in the installation and use of installations for electricity generation. The dominance which has been observed for years in electricity generation continued in 2012.
Gross employment amounted to 377,800 people in 2012:
Biomass accounted for 34% of gross employment. 31% were employed in **wind energy** (117,900 jobs), 99,900 of which were accounted for in onshore wind power and 18,000 employees were involved in offshore developments. **Solar energy** then followed with just under 27% (100,500), **geothermal** with just under 4% (13,900) and **hydropower** with 2% (7,200). Employment in publicly

funded research and administration accounted for a share of just under 3% (9,400) of gross employment.[14]

Gross employment which resulted from the **manufacture of renewable energy installations** was roughly 227,100 in 2012 which is a 6% decrease in comparison to 2011. With just under 59% (133,200 people), the majority of those employed were working in the expansion of domestic capacities. The remaining 41% (94,000 people) were by contrast employed in the export of the installations and components manufactured by companies, a significant proportion of which is made up by electricity generating technology. Developments within the export heavyweight branches cannot be examined in isolation from domestic events since the existence of an expanding domestic market is an important prerequisite for successful export activities.[15]

In the biomass sector, employment in the **supply of fuels for both transport and power** amounted to 60,600 people which translates to a 12% increase in comparison to 2011. Due to the growing number of facilities, employment in **operation and maintenance** is becoming increasingly relevant and increased in 2012 for the first time to over 20%. This corresponds to 21% of gross employment which can be attributed to renewable energies.

[14]See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2013):Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2012-eine erste Abschätzung, Berlin, p.13

[15] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2013):Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2012-eine erste Abschätzung, Berlin, p.5

Tabelle 1: Beschäftigung durch erneuerbare Energien in Deutschland 2012

	Beschäfti-gung durch Investitionen (einschl. Export)	Beschäfti-gung durch Wartung & Betrieb	Beschäftigung durch Brenn-/ Kraftstoff-bereitstellung	Beschäf-tigung gesamt 2012	Beschäf-tigung gesamt 2011
Wind onshore	81.300	18.600		**99.900**	92.500
Wind offshore	17.300	700		**18.000**	8.600
Photovoltaik	78.900	8.900		**87.800**	110.900
Solarthermie	8.500	2.600		**11.100**	12.100
Solarthermische Kraft-werke	1.600			**1.600**	2.000
Wasserkraft	3.100	4.100		**7.200**	7.300
Tiefengeothermie	1.000	400		**1.400**	1.400
oberflächennahe Ge-othermie	8.900	3.600		**12.500**	12.800
Biogas	15.500	17.800	16.200	**49.500**	50.600
flüssige Biomasse stati-onär	0	1.200	300	**1.500**	2.300
Biomasse Kleinanlagen	8.600	14.600	16.100	**39.300**	33.800
Biomasse Heiz-/ Kraft-werke	2.400	8.200	5.300	**15.900**	14.500
Biokraftstoffe			22.700	**22.700**	23.200
Summe	227.100	80.700	60.600	**368.400**	372.000
öffentlich geförderte Forschung/Verwaltung				**9.400**	9.600
Summe				**377.800**	381.600

Source: [16]

2.2 Employment: emerging occupations

In general, 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

[16] See Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, BMU (2013):Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2012-eine erste Abschätzung, Berlin , p. 7

from relevant courses of study is still marginal compared to the overall need for academics.
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 specialist training, particularly as a technician, engineer or craftsman. To a 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.

When considered across all branches, particular quantitative importance is given to the job descriptions of office administrators and industrial clerks, industrial mechanics, electricians, electronic technicians and mechatronics fitters. Companies have expressed a need for engineers, electronic technicians, mechatronics technicians and mechanics.

The following apprenticeship trades are currently in demand:
- Electronics technician for industrial engineering
- Information technology and telecommunications system electronics technician
- Mechatronics fitter
- Industrial mechanic
- 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.

2.3 Training needs in the sector

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. [17] 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

[17] See Kleiss/Stübe(2005) Arbeitsplatzsituation in einem Industrieunternehmen der Solarenergiebranche; in: Wissenschaftsladen 2005, p. 34-36

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 (also see Science Shop Bonn). The bfw offers, for example, numerous VET courses in the wind energy sector (wind centre in Bremerhaven: assembly technician for wind energy installations). Most VET from the bfw is full-time and can be state-paid. 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.

It becomes obvious when considering the required work experience that companies and institutions in renewable energies are forced to make compromises when recruiting personnel. Although the need for experienced personnel remains at a relatively high level, the numbers have at least started to decrease in the solar energy and wind energy branches. Employers have increasingly emphasised their readiness to give inexperienced personnel and young graduates a chance in their job advertisements. Not least, this can also be attributed to the increased competition that the renewable energies branch has faced in recent years from established branches with a technical-industrial orientation. Based on the more attractive general conditions that these branches offer, they are able to exert a kind of magnetic effect on the appropriate employees. In order to particularly avoid the salary pressure which results from such situations, a relatively high number of companies in the renewable energy sector appealed in the first quarter of 2010 to less experienced specialists and offered them relevant VET and knowledge in an attempt to commit them to the company. [18]

[18] See Bühler, Theo (2007), Arbeitsmarktmonitoring Erneuerbare Energien, in: Wissenschaftsladen Bonn (Hrsg.), Informationsdienst Arbeitsmarkt Umweltschutz/Naturwissenschaften Nr.27, 2007, S. IV-VII

3. Recognition of qualifications: experiences in the sector

3.1The system of recognition of competences in the partner country

The term **"recognition"** means both "acknowledgement" and "acceptance". This means that both documentation and certification are comprised in one term: particularly for countries with a highly formalised vocational training system such as Germany, recognition in the sense of entitlement means that it is associated with admission requirements, an external examination and the award of a certificate.[19]

3.1.1 Recognition of formally acquired competences: regulated educational system

In the vocational training system in Germany, formal learning, which means initial vocational training, is of special importance: it builds the foundation of a professional career. It is possible in Germany to complete recognised vocational training (within the dual study system) both at "school" and the "company" as learning locations and as full-time schooling. Further training and VET are of secondary importance when compared to initial vocational training. This means that the recognition of formally acquired competences receives greater acknowledgement on both a social and political level.

The federalist structuring of the education system also makes it extremely heterogeneous: the federal government is only responsible for the nation-wide design of vocational education. Occupational profiles are designed by the Ministry of Education and Research and the Ministry of Economy in accordance with prior consultation and expertise of the social partners coordinated and supported by the Federal Institute for Vocational Education (BIBB). The implementation of the policies again is the responsibility of the Länder and therefore complicated. There are also numerous regulations on VET at the chamber of commerce level. Against this background, transfer opportunities within and between educational sectors pose a major challenge[20] which simultaneously impedes the development of recognition procedures.

3.1.2 Recognition of non-formally acquired competences: unregulated vocational training system

According to the European Commission, non-formal learning is defined as follows:

"Non-formal learning concerns learning that takes place through planned activities (in terms of learning objectives, learning time) where some form of learning support is present (e.g. student-teacher relationships). It may cover programmes to impart work-skills, adult literacy and basic education for early school leavers. Very common cases of non-formal learning include in-company training, through which companies update and improve the skills of their workers such as ICT skills, structured online learning (e.g. by making use of open educational resources), and

[19] See Federal Ministry of Education and Research, BMBF (pub.)(2008): Status of Recognition of non-formal and informal learning in Germany, Bonn, p. 9

[20] See Federal Ministry of Education and Research, BMBF (pub.)(2008): Status of Recognition of non-formal and informal learning in Germany, Bonn, p. 19

courses organised by civil society organisations for their members, their target group or the general public."[21]

As a result, all forms of VET could be understood as non-formal learning: this means that the renewable energy sector offers numerous possibilities for VET, yet the range of training providers is unclear and their training content is not standardised.

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 in Germany. Instead, developments have mostly focused on the acknowledgement of non-formal and informal learning and its evaluation as an essential pre-requisite for recognition. 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 non-formal and informal means are taken into account beyond certification.[22]

3.1.3 Recognition of informally acquired competences

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.[23] 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.

[21] European Commission (2012): Proposal for a council recommendation on the validation of non–formal and informal learning, Brussels, p.17

[22] See section 3.1.3 a+b

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

Some examples of the certification of competences in the sector

a) Procedures in the vocational training

Recognition of informal competences by means of an external students' examination[24]

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 in 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.[25]

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[24] more inforation see: http://www.perspektive-berufsabschluss.de/de/501.php

[25] In the "collective agreement remuneration framework (ERA-TV)" of the metal and electrical industry in Baden-Württemberg, 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.

4. Conclusion

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.
However, due to an increase in labor needs in this sector, there is a lack of professionals in this field, which means that solutions must be strived for.

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.

At the same time, however, it becomes evident that the potential in Germany 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 must forge its own path, a path that is based on its educational system and legal principles which is also decisively supported by all relevant actors.

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13. homepage ProfilPASS: http://www.profilpass-online.de/ (access:30.04.2013)
14. Information about External students examination: http://www.perspektive-berufsabschluss.de/de/501.php (access:30.04.2013)

Annexes

I. Selected occupations

Example of selection of the most relevant occupations in the country

Occupations	Functional area	Functions and tasks	ISCO	Sector	NACE	EQF	ISCED	Evolution of the occupation	Reason for selection
Information technology and telecommunications system electronics technician	Computer systeme, Endgeräte oder Sicherheitssysteme	• Install networks and wireless transmission systems • Set up information technology and telecommunications equipment according due consideration to ergonomic aspects • Deploy expert and diagnostic systems to locate and rectify faults • Carry out work in the capacity of skilled electrical and electronic engineering workers under the provisions of the Prevention of Accidents Regulations	7422	EE	D35.11	3	ISCED 3B	Traditional occupation (1997)	Demanded profile in the industry

Electronics technician for industrial engineering	stored programme control systems or measurement and open and closed loop control plants	• Assemble and install wiring systems, information cables and power lines, including general supply lines • Programme and configure systems, test the functionality and safety facilities of systems • Monitor and maintain plants, carry out checks on a regular basis • Analyse faults, initiate immediate measures and carry out routine repairs to plants • Hand over plants, instruct users in their operation and provide services	7412	EE	D35.11	4	ISCED 3B	New occupation, 2007	Demanded profile in the industry
Mechatronics fitter	assembly and maintenance of complex machinery, plants and systems in the plant engineering and mechanical engineering sectors	• Build and test electrical, pneumatic and hydraulic control systems • Programme mechatronic systems • Assemble, dismantle, secure and transport machinery, systems and plants • Test and adjust the functioning of mechatronic systems • Commission and operate mechatronic systems	7412	EE	D35.11	4	ISCED 3B	New occupation (2011)	Demanded profile in the industry

Industrial mechanic	maintenance, machine and plant construction, production technology and the construction of precision devices.	• Make structural components and subassemblies and assemble them to produce technical systems • Repair technical systems • Carry out maintenance work and inspections	7233	EE	D35.11	4	ISCED 3B	New occupation,2007	Demanded profile in the industry
Plant mechanic for sanitary, heating and air conditioning systems	in the installation and maintenance of complex supply engineering systems.	• Repair and maintain operating equipment • Produce electrical connections for supply engineering plants and systems and install and test electrical subassemblies and components in supply engineering plants and systems • Maintain supply engineering plants and systems	7126	EE	D35.11	4	ISCED 3B	Traditional occupation (2003)	Demanded profile in the industry

II. Competences cards: Occupations described in terms of learning outcomes

PROFILE (ISCO)	7422
ECONOMIC ACTIVITY (NACE)	D 35.11
OCCUPATION	**Information technology and telecommunications system electronics technician**
EQF level	**4**
ISCED level	**3B**
Learning outcome A: To be proficient in the system technology	**Knowledge (A)** - choose components for the information technology and telecommunication system - to consider working environment and work place concerning ergonomics
	Skills (A) setting up and connect information technology and telecommunication systems
	Competences (A) to get in contact with clients
Learning outcome B: Installation	**Knowledge (B)** To consider the electric power supply concerning the connection of the information technology and telecommunication systems.
	Skills (B) **-** to mount equipments, wirings, distributors and connectors on the structure
	Competences (B) - to define procedural safeguards - to document the processes
Learning outcome C: Machine maintenance	**Knowledge (C)** - choosing experts- and diagnostic systems,especially test software. - to check and judge performances
	Skills (C) - check the signals on the interface - check the mains, take network specific measurements
	Competences (C) troubleshooting limit mistakes with the help of a costumer survey

PROFILE (ISCO)	7412
ECONOMIC ACTIVITY (NACE)	D 35.11
OCCUPATION	**Electronics technician for industrial engineering**
EQF level	**4**
ISCED level	**3B**
Learning outcome A: configurate and program controls	**Knowledge (A)** -analyse control programs -adapt architectures, records and cutting points of controllers on networks and bus systems
	Skills (A) - to check operation sequences and adapt program flows
	Competences (A) -to react in a flexibe way
Learning outcome B: Technical analysis of an order, creation of solutions	**Knowledge (B)** **-** determine electric circuit and safeguarding , choose components and lines
	Skills (B) - to plan changes of contructions
	Competences (B) work together with the functional areas of the company, make use of company information flows and participate in company decision processes
Learning outcome C: Technical service and operation	**Knowledge (C)** - to monitor technical constructions - evaluate data of constructions and diagnostic data and use it for improvements
	Skills (C) **-** to determine consumption data of energy and operating materials, to detect reasons for deviation from target value
	Competences (C) - refer customer attention to warranty claims and advise about technical and economic feasibility - to deliver systems, to brief clients in the operation of the machines
Learning outcome D: To install and	**Knowledge (D)** **-** to check the subgrade in oder to anchor sth.

start up of electrical systems	**Skills (D)** To setup, layout, fasten and connect systems, equipments, transmission systems and other operating materials
	Competences (D) Teamwork
Learning outcome E: Maintenance of systems	**Knowledge (E)** to plan service and inspection jobs
	Skills (E) - maintain decentralized energy supply systems
	Competences (E) Conflict management ability

PROFILE (ISCO)	7412
ECONOMIC ACTIVITY (NACE)	D 35.11
OCCUPATION	**Mechatronics fitter**
EQF level	**4**
ISCED level	**3B**
Learning outcome A: Measure and check electrical parameters	**Knowledge (A)** -to choose methods and measuring instruments, estimate measuring errors and build up measuring instruments
	Skills (A) - to check electrical characteristics of assemblies and components
	Competences (A) -to determine work steps according to functional, productional engineering and economical criteria
Learning outcome B: To install and test components of hard- and software	**Knowledge (B)** To assemble and connect system components
	Skills (B) To check hard- und software interfaces, compatibility of hardware components and system prerequisites of software
	Competences (B) **-** to build up and connect electrical, pneumatical and hydraulic circuits

Learning outcome C: to build up and check electrical, pneumatical and hydraulic circuits	**Knowledge (C)** **-** to allocate control concepts and choose electronic control equipments - to check and set the coordination of linked functions, to localize errors considering the interfaces
	Skills (C) **-** to measure and set the compression in pneumatical and hydraulic systems
	Competences (C) work together with the functional areas of the company, make use of company information flows and participate in company decision processes

PROFILE (ISCO)	7233
ECONOMIC ACTIVITY (NACE)	D 35.11
OCCUPATION	**Industrial mechanic**
EQF level	**4**
ISCED level	**3B**
Learning outcome A: To produce,assembe and disassemble of assemblies, components and systems	**Knowledge (A)** -to analyse technical documents -to contruct and use disassembly and assembly flow charts
	Skills (A) - to changeover mechanics or manufacturing systems -to mount assemblies and components
	Competences (A) To work together with the functional areas of the company, make use of company information flows and participate in company decision processes
Learning outcome B: To ensure the functionality of tecnical systems	**Knowledge (B)** **-** to examine systems, to secure the readiness for operation - to check and set the coordination of linked funktions, to localize errors considering the interfaces
	Skills (B) to examine systems
	Competences (B) to investigate the cause of error and quality defects,to contribute to the elimination and to document the process

Learning outcome C: To maintain the technical systems	**Knowledge (C)** -to work with several functional areas of the company, use operational information flow and to contribute to operational decision processes
	Skills (C) -to maintain, examine, mend or correct machines and systems
	Competences (C) to investigate the cause of error and quality defects,to contribute to the elimination and to document the process
Learning outcome D: To build up, widen and check te electrotechnical components of the control engineering	**Knowledge (D)** To use appropriate safety regulations for the work with electrial systems
	Skills (D) **-** to build up electrical assemblies or components - to install and check electrical assemblies or components which are operated under low volage
	Competences (D) To work together with the functional areas of the company, make use of company information flows and participate in company decision processes

PROFILE (ISCO)	7126
ECONOMIC ACTIVITY (NACE)	D 35.11
OCCUPATION	**Plant mechanic for sanitary, heating and air conditioning systems**
EQF level	**4**
ISCED level	**3B**
Learning outcome A: Maintenance supply systems	**Knowledge A** -to initiate measures in the context of preventive maintenance
	Skills A -to examine and check function of the supply systems -to mend systems
	Competences A - to check, estimate and record the work results - to investigate the cause of error and quality defects, to contribute to the elimination and to document the process - to work together with the functional areas of the company, make use of company information flows and participate in company decision processes

Learning outcome B: To establish electrical connections of components supply technical systems	**Knowledge B** -to distinguish AC motors according to the type, to check the rotational direction
	Skills B -to check electrical control circuitry and phase layout and to start the system step-by-step
	Competences B -to use safety regulations on order to avoid dangers in terms of electricity
Learning outcome C: To implement systems and system technology and startup supply technical systems	**Knowledge C** -to assign components and assemblies to the supply system according to their function - to determine and rate changes and developments in reference to the use of devices and systems which is based on the technological, economical, ecological and social development.
	Competences C - to take customized needs and information, to forward it in the company and to consider it

III. Qualitative analysis (experts)

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